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DEVELOPMENT OF A RESPONSIBLE CONDUCT OF RESEARCH HANDBOOK: A GUIDE FOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) RESEARCHERS

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Abstract

The National Aeronautics and Space Administration (NASA) is committed to the integrity of its research practices and research results. Such commitment is reflected in its policies, resources, and environment for the responsible conduct of research (RCR). Data from NASA officials suggest that instances of detrimental research practices occur and are underreported in official mechanisms. This Capstone Project developed the Responsible Conduct of Research Handbook for NASA Researchers (NASA RCR Handbook) for the NASA research community based on input from NASA officials and an extensive literature review. Once approved by NASA management, the NASA RCR Handbook will augment existing institutional resources by giving an overview of the key elements of RCR and other critical areas, suggesting best practices for avoiding issues, and providing a comprehensive list of relevant NASA policies and points of contact.

In order to make the NASA RCR Handbook effective, the author recommends that the NASA Chief Scientist: 1) inform the NASA research community of the NASA RCR Handbook and give widespread access to it; 2) solicit input from the NASA research community on how best to improve it and revise, and 3) assign a point of contact or office to periodically review the NASA RCR Handbook and ensure its relevance and compliance to NASA and federal policy. The author also recommends that other federal research agencies develop a similar handbook for their staff. The NASA RCR Handbook is designed to ensure that NASA staff are aware of best practices for RCR, where to find more information, and who to go to for help resolving concerns.

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Glossary

Detrimental research practices. A broad term for actions that violate the standard, professional practices of the research community.

Responsible conduct of research. Adherence to the shared ethical standards and requirements of the research community encompassing nine broad areas: research misconduct, the protection of human subjects, the welfare of laboratory animals, conflicts of interest, data management practices, mentor and trainee responsibilities, collaborative research, authorship and publication; peer review.[1]

Research misconduct. Fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.[2]

[1] Nicholas H. Steneck, *Introduction to the Responsible Conduct of Research* (2007) PAGE, https://ori.hhs.gov/sites/default/files/2018-04/rcrintro.pdf

[2] "Research Misconduct" Title 14 *Code of Federal Regulations,* Pt. 1275 2016 ed.

List of Abbreviations

CFR	Code of Federal Regulations
EAR	Export Administration Regulations
FY	Fiscal Year
HRIRB	Human Research Institutional Review Board
IACUC	Intuitional Animal Care and Use Committee
ITAR	International Traffic in Arms Regulations
MMR	Measles, Mumps, and Rubella
NASA	National Aeronautics and Space Administration
NCURA	National Council of University Research Administrators
OCS	Office of the Chief Scientist
PI	Principal Investigator
USD	United States Dollar
RED	Research, Engineering, and Development
RCR	Responsible Conduct of Research
RIO	Research Integrity Officer

Chapter 1. Introduction

1.1. Background.

The National Aeronautics and Space Administration (NASA) is one of the federal government's premier research agencies. Its vision, "to discover and expand knowledge for the benefit of humanity," is made possible by extensive research, engineering, and development (RED) in dozens of scientific and technical fields.[3] In fiscal year (FY) 2019, NASA spent more than $11 billion USD in RED and an additional $1.1 billion in grants.[4] Nearly 65% of its workforce are in science and engineering positions.[5]

As with most research institutions, the integrity and quality of its scientific and technical output, the well-being of its researchers and research subjects, and the appropriate stewardship of public funds are critical to NASA. NASA senior management, including the agency Chief Scientist continue to emphasize the importance of research integrity to NASA staff and provide the necessary resources to ensure staff are informed of and adhere to the best practices for the responsible conduct of research (RCR) and relevant NASA and federal policies. To date, its ongoing initiatives addressing this goal include: 1) the development of a NASA-specific research misconduct and integrity training course for all NASA research staff and their supervisors. This online training builds off of a pilot course for the agency developed by the NASA Ames Office of the Chief Scientist and external experts at San Jose State University, the University of

[3] NASA, "NASA Strategic Plan," 2018, https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf
[4] NASA, "FY2019 Agency Financial Report," November 19, 2019, https://www.nasa.gov/sites/default/files/atoms/files/afr19_508_tagged_reassembled_v2.pdf
[5] NASA "Workforce Information Cubes for NASA," last modified September 12, 2020. https://wicn.nssc.nasa.gov/wicn_cubes.html

California at San Francisco, and Stanford University[6]; 2) the designation and formal training of Research Integrity Officers at each NASA center to augment existing avenues of support for researchers which include the Ombudsman Program, the Chief Counsel, the Human Research Institutional Review Board (HRIRB), the ground and flight Institutional Animal Care and Use Committee (IACUC) and other institutional programs; 3) the development of an agency-wide tracking and reporting system for findings and allegations of research misconduct and detrimental research practices; and 4) the creation of a handbook for the responsible conduct of research at NASA. Such a handbook, the Responsible Conduct of Research Handbook for NASA Researchers (NASA RCR Handbook), is designed to be a central resource for all NASA research staff and is the subject of this Capstone Project.

1.2. Statement of the Problem.

One of NASA's core values is integrity. The agency "is committed to maintaining an environment of trust, built upon honesty, ethical behavior, respect, and candor."[7] It is NASA policy to "maintain the highest standards of scientific and technical integrity."[8] However, like all research institutions NASA is not immune to instances of research misconduct or detrimental research practices. While there are no recent instances of the Office of the Inspector General investigations into allegations of research misconduct, upper-level NASA management officials have reported issues within the NASA research community that have a negative impact on NASA researchers' career development, but

[6] "Research Ethics and Integrity Lecture Series," NASA Ames Office of the Chief Scientist, last modified November 2, 2018, https://www.nasa.gov/ames/ocs/researchethics.
[7] NASA, "NPD 1000.0A - NASA Governance and Strategic Management Handbook," January 29, 2020, https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=1000&s=0B
[8] NASA, "NPD 1920.1 - Scientific Integrity," December 12, 2017, https://nodis3.gsfc.nasa.gov/npg_img/N_PD_1920_0001_/N_PD_1920_0001__main.pdf

do not rise to the level of breaking NASA policy or federal law. These reported issues are detrimental research practices and include authorship disputes and management intervention in publishing research results. Additionally, literature indicates that the frequency and number of research misconduct cases are increasing world-wide.[9] Such findings highlight the importance of the responsible conduct of research policies and procedures.

NASA research staff currently have no mandatory education for the responsible conduct of research other than periodic training in the use of human subjects in research or periodic training in the use of animals in research. [10] Both are required before a researcher can use human or animal research subjects. The training takes place prior to submitting a protocol to the HRIRB or to the ground or flight IACUCs. An online training course "Research Misconduct and Integrity," developed in part by the author of this Capstone Project, is pending final review and is expected to be released later in 2020 or early 2021. The course helped form the development of the NASA RCR Handbook's content and structure.

Additionally, NASA policy documents outline broad values, official responsibilities, and remediation procedures for responding to allegations of research misconduct. However, they do not detail best practices for the responsible conduct of research. NASA management officials, including the agency and center Chief Scientists are actively strengthening NASA research integrity policies and trainings. The creation of

[9] R. Grant Steen, Arturo Casadevall, Ferric C. Fang, "Why Has the Number of Scientific Retractions Increased?" *PLoS One* 8, no. 7 (2013) https://doi.org/10.1371/journal.pone.0068397; Fanelli, "How Many Scientists Fabricate and Falsify Research?"

[10] However, there is exhaustive NASA training covering ethical and legal conduct for federal employees, conflicts of interest, export control regulations, laboratory safety, and whistleblower protection. These trainings are not specifically targeted to the conduct, dissemination, and review of NASA research.

the NASA RCR Handbook is at the suggestion of the NASA Ames Research Center Chief Scientist and is meant to help address these problems and to augment existing and upcoming NASA resources.

1.3. Project Question.

Development of the NASA RCR Handbook addresses the questions: 1) what information regarding the responsible conduct of research should be given to NASA researchers and research support staff/managers so that such information is relevant, comprehensive, easily accessible, effective, and understandable; 2) how does one balance compliance to NASA policy with administrative burden; and 3) what roles research administrators, institution officials, and policy makers play in creating and sustaining an environment conducive to the responsible conduct or research.

1.4. Project Objectives.

In order to be effective, the NASA RCR Handbook must be a thorough review of best practices for the responsible conduct of research and relevant NASA polices and federal guidance. It is intended to be a central resource for all NASA researchers and support staff. The NASA RCR Handbook will be available online to supplement other NASA resources, such as online trainings, which are only available periodically, and policy documents. By doing so, the NASA RCR Handbook will reach 1) a broad audience who needs quick or easy access to comprehensive information; 2) new hires who have not yet been exposed to other resources; and 3) those who may need a refresher on NASA policies and other best practices.

1.5. Significance.

As stated earlier, the development of the NASA RCR Handbook is one part of the effort to foster the responsible conduct of research at NASA. Together these efforts are designed to increase compliance with NASA and federal policies by ensuring wide-spread education of acceptable practices, encouraging adherence to the responsible conduct of research best practices, ensuring the continued excellence of NASA's scientific and technical output, and supporting the professional well-being and growth of NASA staff. The NASA RCR Handbook is expected to contribute to this by acting as an easy-to-use reference guide for researchers, managers, and support staff to access key information on policies, additional resources, and designated points of contact for assistance.

1.6. Exclusions and Limitations.

Practically, the NASA RCR Handbook cannot include all information about the responsible conduct of research nor all NASA and federal policies. The NASA RCR Handbook must be short enough to be pragmatic, yet comprehensive enough to accurately represent necessary information for researchers. Additionally, it is meant to augment the existing document, "NASA Guidelines for Promoting Scientific and Research Integrity"[11] which reviews policies for internal and external researchers and the existing online training course, "Research Misconduct and Integrity." As such, the NASA RCR Handbook deliberately does not address in detail certain areas that are covered by existing NASA resources or areas that were deemed beyond the scope of this project by

[11] NASA Office of the Chief Scientist, "NASA Guidelines for Promoting Scientific and Research Integrity," June 2018, https://www.nasa.gov/sites/default/files/atoms/files/nasa_guidelines_for_promoting_scientific_and_research_integrity-july_2018.pdf

the author and the NASA Ames Chief Scientist. For example, the NASA RCR Handbook does not include details about the ethical principles of human or animal research, procurement ethics for research materials or contracts, biosafety, human or animal tissue repository practices or ethics, nor other compliance requirements. Exclusion or minimal discussion of these, or other areas, does not diminish their importance in the research enterprise or to NASA.

Chapter 2. Literature Review

2.1. Overview of Literature Review.

Research for the development of the NASA RCR Handbook focused on four broad areas of literature. First, the author searched for information about the responsible conduct of research for data in two areas: 1) defining research misconduct and detrimental research practices, and their consequences and prevalence; and 2) common detrimental research practices covered by literature and best practices for addressing them.

The second broad focus area was the role research administrators and institutional officials play in developing and maintaining a work environment that encourages the responsible conduct of research. Sources included the National Council of University Research Administrators (NCURA) *Research Management Review* and the bi-monthly *NCURA Magazine*, the Society of Research Administrators International's *Journal of Research Administration*, and a variety of other peer-reviewed journals.

The third focus was on effective training and handbook creation. The author reviewed literature related to the efficacy of trainings in the responsible conduct of research, guidelines on developing effective handbooks, and examples of existing handbooks related to the responsible conduct of research at various comparable institutions. Sources included research administration-specific publications, peer-reviewed journals, and the external websites of federal and non-federal (e.g. academia) institutions.

The fourth and final focus area for the literature review was compiling the relevant Federal and NASA polices. Sources include the Code of Federal Regulations, the

United States Code, the Office of Science and Technology Policy, and NASA's internal and external websites.

2.2. Details of Review.

2.2.1. Misconduct in Science.

Ensuring the responsible conduct of research is critical to research institutions. All federal granting agencies, including NASA, define research misconduct as fabrication, falsification, or plagiarism. Fabrication is "making up data or results and recording or reporting them." Falsification is "manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record." Plagiarism is "the appropriation of another person's ideas, processes, results, or words without giving appropriate credit."[12] However, researchers are held to substantially higher professional standards than simply avoiding research misconduct. Detrimental research practices are actions that violate the shared professional standards and values of the research community[13] and include inaccurately or unfairly allocating credit in publications of acknowledgements, intentionally failing to appropriately retain data, violating reviewer confidentiality or responsibilities, and intentionally executing experiments with negligent or faulty scientific designs. Both research misconduct and detrimental research practices can do significant and long-lasting damage to research subjects, researchers, the institution, the scientific record, and the public.

[12] "Research Misconduct" Title 14 *Code of Federal Regulations,* Pt. 1275 2016 ed.
[13] National Academies of Sciences, Engineering, and Medicine, *Fostering Integrity in Research* (Washington, DC: The National Academies Press, 2017), https://doi.org/10.17226/21896

The consequences of research misconduct can be substantial. Every aspect of the research enterprise can be affected by allegations or findings of misbehavior at every point in the research cycle from concept development to reporting results. Tainted research results, either due to research misconduct or faulty research design, can do incredible damage to the scientific record and can diminish public trust in research results. A well-known example is the Andrew Wakefield et al. paper suggesting a connection between the measles, mumps, and rubella (MMR) vaccine and autism. The study design was found to be scientifically flawed and unethical, and the paper was retracted a few months after publication.[14] Still, the Wakefield paper had, and continues to have, an unprecedented effect on MMR vaccine rates and public attitudes towards vaccination throughout the world.[15] Even in cases not so sensationalized as the Wakefield case, studies found to be faulty continue to pervade the scientific literature years after retraction.[16]

Research misconduct also harms the institution. An institution's reputation can be damaged by producing faulty research results and for failing to foster an appropriate work environment. For example, when celebrity scientist Haruko Obokata was accused of research misconduct, a panel of external experts called for her institution, the Institute of Physical and Chemical Research (Riken) in Japan, to be disbanded due to "poor

[14] T. S. Sathyanarayana Rao and Chittaranjan Andrade, "The MMR vaccine and autism: Sensation, refutation, retraction, and fraud" *Indian Journal of Psychiatry* 53 no. 2 (2011): 95-96, https://doi.org/10.4103/0019-5545.82529

[15] Julie Leask, Robert Booy and Peter B McIntyre, "MMR, Wakefield and *The Lancet*: what can we learn?" *The Medical Journal of Australia* 193 no.1 (July 2010): 5-7, https://doi.org/10.5694/j.1326-5377.2010.tb03730.x

[16] K.M. Korpela, "How long does it take for the scientific literature to purge itself of fraudulent material?: the Breuning case revisited" *Current Medical Research and Opinion* 26, no. 4 (2010): https://doi.org/10.1185/03007991003603804

governance."[17] In the United States, federal granting agencies retain the right to implement substantial administrative consequences for findings of research misconduct. including letters of reprimand, suspension or termination of an award, and suspension or debarment of an individual, department or institution.[18] Awarded institutions may levy additional sanctions against principal investigators (PIs) found guilty of research misconduct as permitted by institutional policy, including stopping merit increases for a period of time or terminating employment.

There are also financial ramifications to findings of research misconduct. In rare cases, a private plaintiff can file a *qui tam* action under the False Claims Act against an individual or institution who knowingly submits false or fraudulent claims to the government.[19] If successful, *qui tam* suits can result in institutions repaying the federal government millions of dollars. Such as in the case of Joseph Thomas' allegation that Duke University knowingly allowed researcher Erin Potts-Kant to submit falsified data to the National Institutes of Health; Duke settled with the government and agreed to repay $112.5 million.[20] Of course, not all allegations or findings of false claims will carry such severe consequences. However, one study found that investigating an allegation of research misconduct cost the institution approximately $525,000.[21] Given the significant,

[17] "Reforming Riken," *The Japan Times,* editorial, June 17, 2014, https://www.japantimes.co.jp/opinion/2014/06/17/editorials/reforming-riken/
[18] "Administrative Actions" Title 14 *Code of Federal Regulations,* Pt. 1275.106(a) 2016 ed.
[19] Department of Justice, "The False Claims Act: A Primer," *Department of Justice*, 2011, https://www.justice.gov/sites/default/files/civil/legacy/2011/04/22/C-FRAUDS_FCA_Primer.pdf
[20] "Duke University Agrees to Pay U.S. $112.5 Million to Settle False Claims Act Allegations Related to Scientific Research Misconduct" Department of Justice, March 25, 2019, accessed October 4, 2020
[21] Arthur M. Michalek, Alan D. Hutson, Camille P. Wicher, Donald L. Trump, "The Costs and Underappreciated Consequences of Research Misconduct: A Case Study" *PLoS Medicine* 7, no. 8 (August 2010): https://doi.org/10.1371/journal.pmed.1000318

potential consequences of bad publicity, administrative actions, and fines, institutions must understand the criticality of promoting the responsible conduct of research.

Individual researchers bear many of the consequences of research misconduct or detrimental research practices. If found guilty of misconduct, researchers will likely struggle to regain professional credibility even after official reprimands end[22] or they may face legal consequences such as criminal conviction, as was the case of Stephen Breuning, the former director of psychological services at the Polk Center.[23] Misconduct and detrimental research practices erode trust between colleagues. In instances of corroborated misconduct, colleagues and collaborators may be stigmatized by association. This was the case with the previously mentioned Obokata scandal. Her colleague, Yoshiki Sasai was cleared of wrongdoing, but later committed suicide after describing himself as being "overwhelmed with shame."[24]

The NASA RCR Handbook is not intended to be the reader's first introduction to the responsible conduct of research; it is a brief overview of material and concepts that were likely taught at the undergraduate, graduate, and post-doctoral levels. The literature for this section of the Capstone Project focused on gathering data on two additional aspects of the responsible conduct of research. First, establishing the prevalence of research misconduct and detrimental research practices. Although there is no clear

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[22] Kyle L. Galbraith, "Life After Research Misconduct: Punishments and the Pursuit of Second Chances" *Journal of Empirical Research on Human Research Ethics* 12, no. 1 (February 2017): 26-32, https://doi.org/10.1177/1556264616682568; Dennis Normile, "Second Act" *Science* 343, no. 6168: 244-247, https://doi.org/10.1126/science.343.6168.244

[23] Paul W. Valentine, "Drug Researcher Pleads Guilty to Fraud," *Washington Post,* September 20, 1988, accessed October 4, 2020, https://www.washingtonpost.com/archive/politics/1988/09/20/drug-researcher-pleads-guilty-to-fraud/a4daf1e0-fdd3-4310-955f-cba985330c86/

[24] David Cyranoski, "Researcher's death shocks Japan" *News Blog* (blog), *Nature*, August 5, 2014, http://blogs.nature.com/news/2014/08/researchers-death-shocks-japan.html; Alexander Martin, "Japanese Stem-Cell Scientist Yoshiki Sasai Commits Suicide," *The Wall Street Journal,* August 5, 2014, https://www.wsj.com/articles/japanese-stem-cell-scientist-yoshiki-sasai-is-dead-1407206857

consensus on the frequency with which researchers violate the responsible conduct of research,[25] many studies agree that misconduct and retractions of publications[26] are on the rise despite the average individual publication rate remaining constant.[27] Analyses of confirmed cases in government-sponsored research suggest that the number of researchers who commit misconduct may range from 1 in 100,000[28] to 1 in 10,000.[29] Studies also reveal that a significant portion of researchers admit to violations of professional standards. Survey data suggest that up to 33% of researchers admit to committing detrimental research practices.[30] One study reported that up to 14% of researchers have knowledge of a colleague committing falsification and up to 72% have knowledge of a colleague's detrimental research practices.[31] Due to the sensitive nature of the questions, survey-based conclusions are considered to be "conservative estimate[s] of the true prevalence of scientific misconduct."[32] Studies such as these highlight the importance of providing resources to researchers so that they better understand acceptable practices and institutional avenues for assistance.

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[25] Fanelli, "How Many Scientists Fabricate and Falsify Research?;"; Eliot Marshall, "How Prevalent Is Fraud? That's a Million-Dollar Question" *Science* 290 no. 5497 (December 2000): 1662-1663, https://doi.org/10.1126/science.290.5497.1662

[26] Sara B Nath, Steven C Marcus and Benjamin G Druss, "Retractions in the research literature: misconduct or mistakes?" *Medical Journal of Australia*, 185 (2006): 152-154, https://doi.org/10.5694/j.1326-5377.2006.tb00504.x; R Grant Steen, "Retractions in the scientific literature: do authors deliberately commit research fraud?" *Journal of Medical Ethics* 37 no. 2 (2011): 113-117, https://jme.bmj.com/content/37/2/113 ; Steen, "Retractions in the scientific literature."

[27] Daniele Fanelli and Vincent Larivière, "Researchers' Individual Publication Rate Has Not Increased in a Century" *PLoS One* 11, no. 3 (2016), https://doi.org/10.1371/journal.pone.0149504

[28] Marshal, "How Prevalent Is Fraud"

[29] Fanelli, "How Many Scientists Fabricate and Falsify Research?"

[30] Maura Lerner, "One-Third Admit to Research Violations; Survey of Scientists Finds a Wide Range of Misconduct" *Star Tribune*, June 09, 2005, http://proxy.library.jhu.edu/login?url=https://www-proquest-com.proxy1.library.jhu.edu/docview/427722102?accountid=11752; Leslie K. John, George Loewenstein, and Drazen Prelec, "Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling" *Psychological Science* 23, no. 5 (2012): 524-532, https://doi.org/10.1177/0956797611430953

[31] Fanelli, "How Many Scientists Fabricate and Falsify Research?"

[32] Ibid.

The second focus was identifying the shared values and accepted standards of the research community and identifying corresponding best practices. No commonly agreed upon definition exists for the responsible conduct of research.[33] The nuances of shared professional values changes between research disciplines[34] and regions.[35] At the heart of the responsible conduct of research are the shared internal and external obligations of the research community. Everyone involved in the research process is expected to adhere to the internal values of objectivity, honesty, openness, fairness, accountability, and stewardship.[36] Likewise, the research community must fulfill their obligations to 1) others in the research community, by producing technically sound research results; 2) to their institution, by protecting its reputation, 3) to the public, who benefits from the results of research and who fund research activities;[37] and 4) to the human or animal subjects, who the researcher must protect.

Both research misconduct and detrimental research practices violate the internal and external obligations of the research community. Based on the Department of Human Health and Service's Office of Research Integrity's, the preeminent organization for the responsible conduct of research within the federal government, guidelines,[38] the author focused on: 1) the protection of human subjects and animal subjects; 2) the effects of healthy relationships between mentors and mentees and between colleagues; 3) avoiding

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[33] David B. Resnik, Lisa M. Rasmissen and Grace E. Kissling, "An International Study of Research Misconduct Policies" *Accountability in Research* 22, no. 5 (2015): 249-266, https://doi.org/10.1080/08989621.2014.958218

[34] Dubravka Komić, Stjepan Ljudevit Marušić, Ana Marušić, "Research Integrity and Research Ethics in Professional Codes of Ethics: Survey of Terminology Used by Professional Organizations across Research Disciplines" *PLoS One* 10, no. 7 (2015): https://doi.org/10.1371/journal.pone.0133662

[35] Resnik, Rasmissen and Kissling, "An International Study of Research Misconduct Policies"

[36] National Academies of Sciences, Engineering, and Medicine, "Fostering Integrity in Research"

[37] Ibid.

[38] Nicholas H. Steneck, *Introduction to the Responsible Conduct of Research* (2007), https://ori.hhs.gov/sites/default/files/2018-04/rcrintro.pdf

conflicts of interest and external influence in performing, reporting, and reviewing research; 4) appropriate data retention, analysis, and presentation; 5) accurate and fair allocation of credit (i.e. authorship); 6) collaborative research; and 7) peer review. This list is not exhaustive, but it covers many of the primary aspects of NASA research and serves as the basis for the areas covered in the NASA RCR Handbook.

2.2.2. Research Administration and Institution-level Responsibility.

The responsible conduct of research involves everyone at the institution, not just the researchers.[39] Institution responsibility in creating an environment that promotes the proper environment is critical.[40] The implementation of policies for responding to research misconduct is both federally mandated[41] and also sends a strong message that such behavior is unacceptable.[42] However, policies for adjudicating allegations alone are insufficient in creating an environment that prioritizes the responsible conduct of research.[43] Policies should be combined with other initiatives like training or educational programs, rewarding exceptional behavior, developing a mentorship program for junior staff, institution annual reports, and publicly posting relevant information.[44] Such initiatives must come from institutional leaders.[45]

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[39] Debra S. Schaller-Demers, "Responsible Conduct of Research: Not Just for Researchers" *Journal of Research Administration* 46, no. 1 (2015): 63-76, https://files.eric.ed.gov/fulltext/EJ1156088.pdf
[40] Institute of Medicine and National Research Council, *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct* (Washington DC: The National Academies Press), https://doi.org/10.17226/10430
[41] "Executive Office of the President; Federal Policy on Research Misconduct; Preamble for Research Misconduct Policy" 65 *Federal Register* 235 (6 December 2000), pp. 76260-76264
[42] Institute of Medicine and National Research Council, *Integrity in Scientific Research"*
[43] Institute of Medicine and National Research Council, *Integrity in Scientific Research;"* Laetus O.K. Lategan "The Building of a Responsible Research Community: The Role of Ethics" *Journal of Research Administration* 43, no. 1 (2012): 85-97, https://files.eric.ed.gov/fulltext/EJ976743.pdf
[44] Institute of Medicine and National Research Council "Integrity in Scientific Research;" David Brown, "Effective Compliance in a Shifting Regulatory Environment" *NCURA Magazine* 47, no. 5 (2015): 65-67, https://www.ncura.edu/Portals/0/PDF/OctNov2015_NCURA_Mag.pdf
[45] William Wiener, "Promoting Leadership in Research Integrity" *NCURA Magazine* 43, no. 9 (2011): 12-13, https://www.ncura.edu/Portals/0/Docs/Magazine/2011/MarApril2011.pdf

Managers, coordinators, and administrators who oversee and support research, help develop, implement and administer institutional strategy and scientific program development, administer funds and oversee budgets, assist with the professional development of researchers,[46] and frequently encounter situations with "competing" responsibilities.[47] It is, therefore, critical that research support staff also be trained in the responsible conduct of research and that they stay up to date on relevant policies and procedures.[48] The NASA RCR Handbook is therefore meant to be a reference for both researchers and support staff.

Research support staff, including research administrators, must understand the needs and interests of researchers.[49] Administrative burden on researchers is the work hours spent doing administrative tasks other than research like hiring staff and writing reports and it is a well-documented issue among the research administrative community.[50] The responsible conduct of research training is one such burden and that must be balanced.[51] Frequent communication explaining policies is critical and support staff should make every effort to ensure that policies resonate with staff.[52]

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[46] Linda Evans, "What Research Administrators Need to Know about Researcher Development: Towards a New Conceptual Model" *Journal of Research Administration* 42, no. 1 (2011): https://files.eric.ed.gov/fulltext/EJ954989.pdf

[47] Stephen Erickson and Karen M.T. Muskavitch, "Administrators and the Responsible Conduct of Research" *Office of Research Integrity,* accessed October 1, 2020.

[48] Beryline Temples, Paula Simons, and Timothy N. Atkinson, "Case Study: Research Administration Training and Compliance at the Department Level for a Predominantly Undergraduate Institution" *Research Management Review* 19, no. 1 (2012): 42-60, https://www.ncura.edu/Portals/0/Docs/RMR/v19n1.pdf?ver=2013-10-21-181452-000

[49] Evans, "What research administrators need to know about researcher development"

[50] Sara Rockwell, "The FDP Faculty Burden Survey" *Research Management Review* 16, no. 2 (2009): 29-44, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2887040/pdf/nihms-156127.pdf; Temples, Simons, and Atkinson, "Research Administration Training and Compliance"

[51] Samuel L. Stanley, Jr. and Denise A. McCartney, "Balancing the Burden of Compliance and Faculty Support" *Research Management Review* 16, no. 2 (2009): 14-21, https://www.ncura.edu/Portals/0/Docs/RMR/v16n2.pdf?ver=2015-03-16-163002-000

[52] Stanley and McCartney, "Balancing the Burden"

2.2.3. Effective Handbooks and Effective RCR Training.

The third focus of the literature review was understanding strategies for developing an effective handbook and looked for and reviewed information regarding handbook development, effective training in the responsible conduct of research, and examples of similar handbooks. Much of the research regarding the benefits and development of handbooks is well beyond the scope of this Capstone Project. For example, some literature focuses on how handbooks can help businesses avoid and defend against lawsuits.[53] However, many of the recommendations for handbooks can be extrapolated to apply to the NASA RCR Handbook.

Handbooks should be written in simple, understandable language.[54] They should create interest in the topic, establish an understanding of what the employee and employer can expect from the other, and be a thorough review of the relevant and up to date policies.[55] Only the policies that are fundamental to employee understanding,[56] and the procedures for making sure they are accomplished,[57] should be included in the handbook. It should also include a disclaimer that the handbook does not cover all policies.[58] Several articles highlight the importance of ensuring that employees are given

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[53] Stacy Gavin and I.M. Jawahar, "Writing An Employee Handbook" (2002): 23-28, https://www.abacademies.org/Public/Proceedings/Proceedings10/paoe-8-1-nash02.pdf

[54] Deutsh, "What to put in your employee manual;" Berkeley Rice "Practice Pointers: What Goes Into An Employee Handbook" *Medical Economics* 83, no. 1 (2006): 56-60, http://search.ebscohost.com.proxy1.library.jhu.edu/login.aspx?direct=true&AuthType=ip,shib&db=ofm&AN=510525874&site=ehostlive&scope=site&authtype=ip,shib&custid=s3555202

[55] Davis and Hopkins, "Readability of Employee Handbooks;" Deutsh, "What to put in your employee manual"

[56] NFIB, "NFIB Guide to the Employee Handbook: How to Create a Custom and Effective Handbook for your Employees," 2012, https://www.nfib.com/portals/0/PDF/Members/Legal/Guides/employee_handbook.pdf

[57] Rice "Practice Pointers"

[58] Rice "Practice Pointers;" Cheylynn Hayman, "Look Closer at you Employee Handbook" *Enterprise/Salt Lake City* 40, no. 9 , (December 17-30 2012): 9, http://search.ebscohost.com.proxy1.library.jhu.edu/login.aspx?direct=true&AuthType=ip,shib&db=f5h&AN=84605106&site=ehost-live&scope=site

a copy of the handbook (e.g. at a new hire orientation) and recommend implementing a mandatory acknowledgement of receipt or testing employees on the content of the handbook to ensure that they have read it.[59] This literature helped contribute to the development and implementation of the NASA RCR Handbook.

2.2.3.1. Responsible Conduct of Research.

The other focus of this section was literature dedicated to assessing the efficacy of training for the responsible conduct of research. While this literature does not directly address the role that handbooks play in training staff, the strategies and known shortcomings of RCR trainings can help inform the content and deployment of the handbook. As one article stated, "there is still no consensus about what such [RCR] training should include, how it should be delivered, nor what constitutes "effectiveness" of such training."[60] However, the Office of Research Integrity suggests that there are nine core areas that responsible conduct of research should address: 1) research misconduct; 2) the protection of human subjects; 3) the welfare of laboratory animals; 4) conflicts of interest; 5) data management practices; 6) mentor and trainee responsibilities; 7) collaborative

[59] Jonathan Deutsh, "What to put in your employee manual" *Restaurant Business* August 4, 2014, https://www.restaurantbusinessonline.com/advice-guy/what-put-your-employee-manual; Rice "Practice Pointers;" Marianne Monroy and Andrew L. Zwerling, "The Importance of a Good Employee Handbook" *Journal of the American College of Radiology* 11, no. 4 (April 2014): 421-422, https://doi.org/10.1016/j.jacr.2013.12.021; Keith Davis and James O. Hopkins, "Readability of Employee Handbooks" *Personnel Psychology Management Review* 3, no. 3 (September 1950); 317-326, https://doi.org/10.1111/j.1744-6570.1950.tb01706.x; Hayman, "Look Closer at you Employee Handbook"

[60] Dena K. Plemmons and Michael W. Kalichman, "Mentoring for Responsible Research: The Creation of a Curriculum for Faculty to Teach RCR in the Research Environment" *Science and Engineering Ethics* 24 (2018): https://doi.org/10.1007/s11948-017-9897-z

research; 8) authorship and publication; and 9) peer review.[61] Training must be useful across a broad range of experience levels, fields, and contexts.[62]

The third focus of this section was to look for example handbooks from other research institutions regarding the responsible conduct of research. A search of the top ten research institutions[63] in the United States revealed that few had publicly available guidance on the responsible conduct of research that went beyond institutional policy for defining and responding to misconduct, or links to external resources. There were three notable exceptions: 1) Johns Hopkins provides an 11-page document, "Rules and Guidelines for Responsible Conduct of Research"[64] which covers institutional policy and best practices for data gathering, storage and retention; authorship; and publication. 2) Harvard University has several unconsolidated websites like, "Quick Guide for Researchers"[65] and "[Faculty of Arts and Sciences] Research Administration Services"[66] which provide lists of useful internal websites; and 3) Duke

[61] Steneck, *Introduction to the Responsible Conduct of Research*
[62] Rochelle E. Tractenberg and Kevin T. FitzGerald, "A Mastery Rubric for the design and evaluation of an institutional curriculum in the responsible conduct of research" *Assessment & Evaluation in Higher Education* 37, no. 8 (December 2012): 1003–102, https://doi.org/10.1080/02602938.2011.596923
[63] As determined by expenditures in research and development for FY2018. National Science Foundation, "Table 21. Higher education R&D expenditures, ranked by all R&D expenditures, by source of funds: FY 2018" November 13, 2019, accessed October 1, 2020, https://ncsesdata.nsf.gov/herd/2018/html/herd18-dt-tab021.html
[64] Johns Hopkins University, "Rules and Guidelines for Responsible Conduct of Research," https://www.hopkinsmedicine.org/research/resources/offices-policies/OPC/Policies_Regulations/pdfs/Responsible%20Conduct%20of%20Research.July%202008.pdf
[65] "Quick Guide for Researchers:12 Essentials Every Researcher Should Know" Harvard University, accessed October 2, 2020, https://researcherresources.harvard.edu
[66] "Harvard Policies and Guidelines for Faculty of Arts and Sciences (FAS) Researchers" Harvard University, accessed October 2, 2020, https://research.fas.harvard.edu/guidance-for-fas-researchers

University's Office of Scientific Integrity has a document covering best practices for Data Management.[67]

Additionally, the author searched for institutional handbooks for federal employees at the top ten federal agencies.[68] All agencies have policy documents for research misconduct, as is required by law. The author could find no agency that had a publicly accessible handbook for the responsible conduct of research directed toward federal employees. The only expectation was NASA's existing resource "NASA Guidelines for Promoting Scientific and Research integrity."

2.2.4. Federal and NASA Policies.

The final portion of the literature review for this project was compiling the relevant federal and NASA policies that are related to the responsible conduct of research. The author searched internal and external NASA and federal websites. The key policy areas include: 1) the Code of Federal Regulations (CFR) [69] which governs NASA; 2) federal policy for research misconduct[70] and publication;[71] 3) NASA policies for: a)

[67] Duke University, "Duke DMP Guidance Document," January 27, 2020, https://duke.app.box.com/v/DMPGD-fullPDF

[68] Based on R&D expenditures As found provided by Congressional Research Service, "Federal Research and Development (R&D) Funding: FY2020" March 18, 2020, accessed October 1, 2020, https://fas.org/sgp/crs/misc/R45715.pdf

[69] "Aeronautics and Space" Title 14 *Code of Federal Regulations,* 2020 ed.

[70] "Investigation of Research misconduct" Title 14 *Code of Federal Regulations* Pt. 1275

[71] John P. Holdren, "Increasing Access to the Results of Federally Funded Scientific Research," February 22, 2013, https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf

publication[72] b) data retention and management;[73] c) the conduct of research;[74] and d) ethics[75] and research integrity.[76] Other relevant documents include the NASA Governance and Strategic Management Handbook,[77] which establishes NASA's core values.

2.3. Applicability of Literature Review.

The literature described above informed the development of the NASA RCR Handbook by helping to establish the need for such a resource, anchoring it in existing literature, shaping the content, and developing possible metrics for evaluating the efficacy.

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[72] NASA, "NPR 2200.2D - Requirements for Documentation, Approval and Dissemination of Scientific and Technical Information," September 7, 2016, https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=2200&s=2D ; NASA, "NPD 2200.1C - Management of NASA Scientific and Technical Information" January 9, 2020, https://nodis3.gsfc.nasa.gov/npg_img/N_PD_2200_001D_/N_PD_2200_001D__main.pdf ; NASA. "NPD 2230.1 - Research Data and Publication Access" January 14, 2016, https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=2230&s=1

[73] NASA, "NRRS 1441.1 - NASA Records Retention Schedules" May 18, 2020, https://nodis3.gsfc.nasa.gov/NPR_attachments/NRRS_1441.1A.pdf ; NASA, "NPD 1440.6I NASA Records Management," July 11, 2019, https://nodis3.gsfc.nasa.gov/npg_img/N_PD_1440_006I_/N_PD_1440_006I__main.pdf ; NASA, "NPR 1441.1E NASA Records Management Program Requirements" January 29, 2015, https://nodis3.gsfc.nasa.gov/npg_img/N_PR_1441_001E_/N_PR_1441_001E_.pdf

[74] NASA, "NPD 1080.1C - Policy for the Conduct of NASA Research and Technology" November 22, 2016, https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=1080&s=1C

[75] NASA, "NPD 1900.9F Ethics Program Management" Septmeber1, 2020, https://nodis3.gsfc.nasa.gov/npg_img/N_PD_1900_009F_/N_PD_1900_009F__main.pdf ; NASA, "NPR 1900.3B Ethics Program Management" April 23, 2007 https://nodis3.gsfc.nasa.gov/npg_img/N_PR_1900_003B_/N_PR_1900_003B_.pdf

[76] NASA, "NPD 1920.1 Scientific Integrity" December 17, 2020, https://nodis3.gsfc.nasa.gov/npg_img/N_PD_1920_0001_/N_PD_1920_0001__main.pdf

[77] NASA, "NPD 1000.0A"

Chapter 3. Need(s) Assessment

3.1. Need(s) Assessment.

The need for this project was established by several means. Primarily, the NASA Ames Research Center Chief Scientist requested that the existing document, "NASA Guidelines for Promoting Scientific and Research integrity" be augmented by an additional handbook reviewing the basics of the responsible conduct of research and summarizing the relevant NASA and federal policies. Additionally, representatives from the NASA Science Council report instances of conflict or misbehavior among researchers (e.g., authorship disputes and [non-financial] conflicts of interest in research). Anecdotal reports from NASA research and management staff suggest that instances of detrimental research practices that require management intervention (e.g. resolution from the Research Integrity Officer) occur, but many go unreported. These issues, which do not violate federal law, can have significant consequences on the career of NASA researchers. Together with the previously noted global rise in research misconduct findings and article retractions, NASA management has begun to update and establish new policies and mechanisms for support.

3.2. Metrics.

No specific metrics were used to establish the need for this Capstone Project.

3.3. Sources.

The author conferred with NASA management officials at the center- and agency-level. The NASA Ames Chief Scientist, who is both the supervisor of the author and the official mentor for this Capstone Project was instrumental in establishing the need. The Ames Chief Scientist also relayed data of violations of the accepted practices of the

research community at other NASA centers. Additionally, feedback from a pilot, NASA-specific “Research Misconduct and Integrity” online training course was used to help define the scope of and need for the NASA RCR Handbook. Approximately 50 NASA researchers reviewed the course and provided constructive feedback on the content and delivery. The course feedback was solicited independently of this Capstone Project; however, it provided insight into areas that may need more attention than can realistically be given in a one-hour, online training. The NASA RCR Handbook is one avenue to provide additional resources and information.

Chapter 4. Project Description

4.1. Discussion of Project Elements.

This Capstone Project is the creation of the Responsible Conduct of Research Handbook for NASA Researchers (the NASA RCR Handbook). The NASA RCR Handbook is a compilation of key federal, NASA, and external resources related to the responsible conduct of research for NASA staff at each of the NASA centers and facilities. Due to the fact that the NASA centers and facilities are in 12 different states, the NASA RCR Handbook consider does not local, including state or center, guidance. The NASA RCR Handbook is designed to be a central resource for NASA researchers from all disciplines and experience levels, management officials, and other research support staff.

It is the intention of this Capstone Project that the resulting NASA RCR Handbook be a reference tool that research and management staff utilize and incorporate into their research labs, offices, and cultures. A link to the electronic version of the NASA RCR Handbook will be given to all research and research support staff.

As previously stated, the NASA RCR Handbook is not intended to be a researcher's initial introduction to the responsible conduct of research, nor is it an in-depth review of every aspect of research best practices. Instead, it is designed to give a brief overview of common aspects of the responsible conduct of research and point users to more information and the relevant points of contact for assistance and advice.

Chapter 5. Methodology

5.1. Methodology Overview.

The development of the NASA RCR Handbook required a thorough review of three key areas: 1) the responsible conduct of research literature; 2) input from NASA management; and 3) NASA policies. As previously discussed, the literature review and input from NASA management officials helped form the content and structure of the NASA RCR Handbook. The NASA policy documents contained official guidance for NASA staff and listed the federal regulation under which the policy was developed.

The NASA Ames Chief Scientist is the primary point of contact for reviewing and approving the content of the NASA RCR Handbook. Once an initial draft was developed, the Ames Chief Scientist reviewed and concurred with the content and structure. Subsequent drafts were sent to the agency Associate Chief Scientist for approval. Once the final version is approved, the NASA RCR Handbook will be posted on the internal NASA website.

5.2. Project Design and Discussion.

The NASA RCR Handbook developed under this Capstone Project has seven chapters. Chapter 1 discusses the aspects of NASA as an internal research organization, as opposed to an agency that award grants to external researchers. It covers the basic tenets of NASA's vision, the major NASA research areas, and general statistics on RED expenditures. Chapter 2 is an overview of the responsible conduct of research. It defines relevant terms and professional standards of the research community, discusses how and why those standards may be violated, and highlights the ramifications of violating the responsible conduct of research. Chapter 3 discusses the federal and NASA policies

surrounding research misconduct. It includes the federal definition of research misconduct, to whom the definition applies, and the legal and administrative consequences laid out in 14 CFR 1275.

Chapter 4 covers the definition of detrimental research practices and best practices for avoiding some of the common issues in the responsible conduct of research. It describes 1) publication and authorship, including why it is important to publish research results, NASA and federal specific requirements for publishing, and responsible authorship practices; 2) study design, including a brief overview of the importance of a robust experiment/test protocol; 3) data management practices for acquisition, retention, analysis, and presentation, including the importance of recording and maintaining data per scientific and federal policy, and the importance of presenting data accurately in publications and presentations; 4) bullying, harassment, and the work environment, including how harassment negatively affects researchers and importance of healthy working relationships between mentors and mentees; 5) conflicts of interest in research, including how financial conflicts of interest and personal bias for or against a researcher can affect the research environment and results; 6) human subject research, including the basic ethical principles for the protection of human subjects: respect for persons, beneficence, and justice; 7) animal subject research, including a brief discussion of the NASA basic principles of animal research: respect for life, societal benefit, and nonmaleficence, and other NASA policies; 8) collaborative research, including the importance of NASA agreements with national and international industry, academic, and government partners, and effective communication in collaboration; and 9) peer review

processes, respecting confidentiality and the role peer review plays in the responsible conduct of research.

Chapter 5 discusses other important considerations for the NASA research community that are not a part of the responsible conduct of research. They are: 1) avoiding internal and external influences, including not allowing institutional or political pressure to affect research practices, research results, or technical input to or from advisory committees; 2) export control requirements, including the types of NASA research that typically falls under International Traffic in Arms Regulations (ITAR) and Export Administration Regulations (EAR); 3) laboratory safety, including the role that safety plays in maintaining an effective research environment; and 4) and hiring practices, including a discussion on the importance of diverse and exceptional researchers.

Chapter 6 outlines the importance of reporting issues in the responsible conduct of research, and lists the appropriate points of contact, including their responsibilities. Chapter 7 lists the resources mentioned throughout the NASA RCR Handbook and briefly discusses how NASA policy documents are ranked.

Chapter 6. Project Results and Discussion

6.1. Project Result 1.

The Capstone Project resulted in the NASA RCR Handbook, a guidebook for NASA researchers, management, and support staff. The NASA RCR Handbook addressed the project questions posed in Chapter 1.3. The first question was "what information regarding the responsible conduct of research should be given to NASA researchers and research support staff/managers so that such information is relevant, comprehensive, easily accessible, effective, and understandable."

To answer this question, the author used three methods to determine what content should go into the NASA RCR Handbook: 1) the yet to be released NASA online training course, "Research Misconduct and Integrity," developed in part by the author of this Capstone Project, and the existing document "NASA Guidelines for Promoting Scientific and Research Integrity.[78]" NASA management, research staff, the Ames Office of the Chief Counsel, and a representative from the Department of Health and Human Service's Office of Research Integrity reviewed, gave input on, and approved the content and structure of the course. The "NASA Guidelines for Promoting Scientific and Research Integrity" was developed and approved for release by NASA. 2) The literature, described in Chapter 2, identified nine core elements of the responsible conduct of research. The use of Methods 1 and 2 helped develop a framework of the NASA RCR Handbook's content and structure. 3) Input from the NASA Ames Chief Scientist helped further define the scope.

[78] NASA Office of the Chief Scientist

The author analyzed the input from these three approaches to ensure that the content is relevant to NASA staff and is a comprehensive and understandable overview of the key elements of the responsible conduct of research. Additionally, the NASA RCR Handbook is geared towards everyone in the research enterprise, not just researchers. The NASA RCR Handbook minimizes jargon and it gives a thorough, yet brief, overview of the responsible conduct of research. This way non-researchers can also understand the relevant concepts. Responsibilities of the NASA community at large are clearly listed.

The literature review and input from the NASA Ames Chief Scientist provided ways to ensure that the NASA RCR Handbook was easily accessible. These ways are discussed in Chapter 7.

6.2. Project Result 2.

The second project question was "how does one balance compliance to NASA policy with administrative burden." Administrative burden is the time researchers spend on non-research work. For example, researchers must write reports, manage subordinates, take trainings, and request and receive approval before publishing scientific and technical information. Much of the administrative burden on NASA researchers cannot be eased as it is required by federal policy. The NASA RCR Handbook attempts to mitigate burden in the following ways: 1) by giving a brief, yet effective overview of common issues in the responsible conduct of research so that researchers do not have to wade through inordinate amounts of information for best practices; 2) by giving best practices that will reduce the time needed to resolve issues; and 3) by providing easy access to a comprehensive list of NASA policies and the responsibilities of designated points of contact. This will reduce the burden for the researchers, who will not waste time

searching for information, and for the responsible officials, who will not have to respond to issues outside their responsibilities.

6.3. Project Result 3.

The third project question was "what roles research administrators, institution officials and policy makers play in creating and sustaining an environment conducive to the responsible conduct or research." While individuals are responsible for their own actions, it is federal and NASA policy that senior management officials are ultimately responsible for the integrity of the research performed under their auspices. They are required to "ensure a culture of scientific integrity," "strengthen the actual and perceived credibility of Government research," "facilitate the free flow of scientific and technical information," and "establish principles for conveying scientific and technical information to the public."[79] The NASA RCR Handbook clearly delineates the responsibilities of senior officials. These officials delegate authority and day-to-day operations to others within the organization. These 'responsible offices' are listed in every section of the NASA RCR Handbook.

NASA does not have positions designated as research administrators. However, many different types of positions are relevant to the research enterprise, including budget personnel, line management (i.e. supervisors), and program managers. These non-researcher personnel play a critical role in ensuring the integrity of NASA research. As such, the NASA RCR Handbook is geared towards these personnel as well.

[79] NASA, "Ensuring Scientific Integrity at the National Aeronautics and Space Administration," December 16, 2011, https://www.nasa.gov/pdf/611201main_NASA_SI_Policy_12_15_11.pdf

Chapter 7. Recommendations and Discussion

7.1. Introduction.

The NASA RCR Handbook is just one aspect of a larger initiative in how NASA approaches the responsible conduct of research. The author of this Capstone Project has four recommendations; three for how the NASA Office of the Chief Scientist (OCS) can best utilize the NASA RCR Handbook and one broader recommendation for the federal government.

7.2. Recommendations.

7.2.1. Recommendation 1 – OCS Should Inform Staff & Give Access to the NASA RCR Handbook.

In order to be effective, NASA staff must be aware of and have access to the NASA RCR Handbook. The author recommends that the NASA Office of the Chief Scientist post the NASA RCR Handbook on the internal website of each NASA center and facility. The NASA Chief Scientist or responsible owner (see Recommendation 3) also informs staff its existence by an agency wide email/announcement. Additionally, the author recommends that senior management at the center and agency levels inform their staff of the NASA RCR Handbook.

7.2.2. Recommendation 2 – OCS Should Update & Revise NASA RCR Handbook.

The current version of the NASA RCR Handbook is a pending review and approval by NASA's Office of the General Counsel and OCS. Once approval is given and the NASA RCR Handbook is shared with NASA staff, the author recommends that the OCS seek input from the NASA community. The author recommends that the OCS

post the NASA RCR Handbook on an internal NASA site and that the OCS put out an agency-wide call for comments, suggestions, and improvements by a given due date from NASA researchers, research support staff, and managers. Alternately, the OCS could target specific reviewers from desired demographics (e.g. researchers from various experience levels and fields). The OCS should also solicit external feedback from the Office of Research Integrity and/or other federal agencies. These comments will shape the content and readability of the NASA RCR Handbook to best suit the needs of NASA's researchers, managers, and support staff. The responsible official (see Recommendation 3) must update and revise the NASA RCR Handbook to appropriately reflect reviewer feedback.

Once the NASA RCR Handbook's content is updated, the author recommends that the OCS send it to a graphic artist, or similar, to develop artwork and graphics that improve the aesthetic. After that NASA RCR Handbook should be printed and bound. Physical copies should be distributed to relevant stakeholders, including researchers and managers.

7.2.3. Recommendation 3 – OCS Should Assign Ownership to Specific NASA Staff or Office.

Best practices for the responsible conduct of research and institution policies are constantly changing. It is critical that the NASA RCR Handbook remain up to date in order to be a useful resource. The OCS should assign a person or office to be responsible for periodically reviewing the NASA RCR Handbook to ensure it aligns with current policies and best practices. The author recommends every three years because this coincides with the agency's internal review of research integrity standards, or whenever a

major policy change is made.[80] The responsible owner should revise the document as needed and inform NASA staff of the new edition.

7.2.4. Recommendation 4 – Federal Government Should Develop Handbook.

The author believes that each federal research agency could benefit from a handbook similar to the one developed by this Capstone Project. The federal government should create the skeleton of a handbook with relevant information and best practices for its civil servant and contractor staff. This skeleton should be customized by each agency with its individual needs, and resources and responsible offices.

[80] NASA Office of the Chief Scientist

Chapter 8. Conclusion

As one of the top government research institutions, NASA is committed to the integrity of its research practices and research results. Ensuring that NASA has appropriate policies and resources in place for the responsible conduct of research is a key component of maintaining such integrity. NASA has numerous existing resources and support mechanisms for researchers who encounter problems in the design, conduct, or reporting of research. However, anecdotal reports from senior NASA management officials suggest that issues still occur. Efforts to provide additional support are ongoing.

The product of this Capstone Project is the Responsible Conduct of Research Handbook for NASA Researchers. The NASA RCR Handbook is a central resource for researchers, managers of researchers, and research support staff. It contains overviews, best practices, and official policies for the nine core elements of the responsible conduct of research and other key areas for NASA researchers. The content of the NASA RCR Handbook was developed based on a thorough literature review, input from NASA management, and other existing NASA resources. It is also intended to reduce administrative burden on researchers and support staff by providing the appropriate designated point of conduct who can resolve issues that arise.

The NASA RCR Handbook produced in this Capstone Project is pending review and approval by NASA management officials, including the Office of General Counsel and the NASA Office of the Chief Scientist. Once approval is given, the author recommends that the NASA RCR Handbook be posted on an internal NASA website and announced to agency. The author also recommends establishing ownership of the

document and soliciting feedback from researchers, managers, and support staff to improve the NASA RCR Handbook's content and delivery.

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Appendix 1. The Responsible Conduct of Research Handbook for NASA Researchers

The Responsible Conduct of Research Handbook for NASA Researchers

This is a draft document produced for this Capstone Project course. It will be revised and is pending review and approval by NASA.

Chapter 1: NASA as a Research Organization

The National Aeronautics and Space Administration (NASA) is one of the federal government's premier research organizations. Its vision, "to discover and expand knowledge for the benefit of humanity,"[81] is made possible by extensive research, engineering, and development in dozens of scientific and technical fields in four mission directorates:

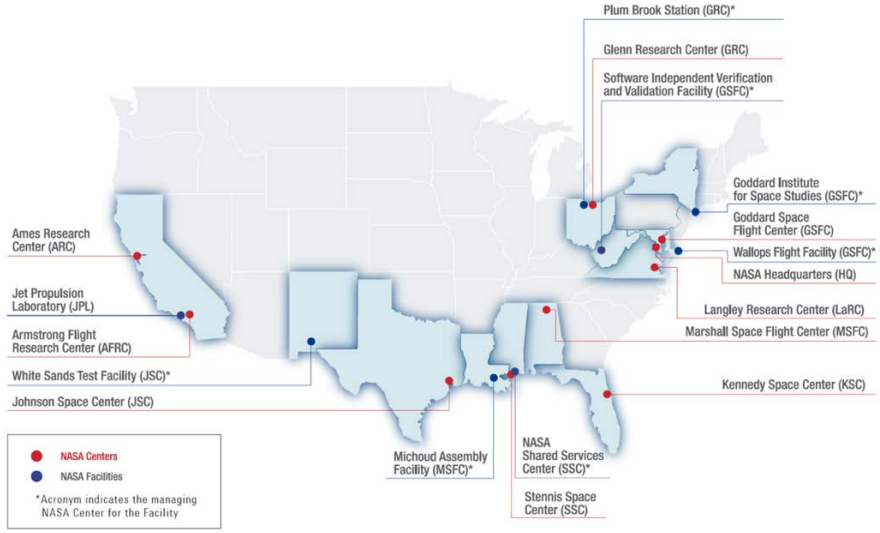
The Science Mission Directorate (SMD) expands the frontiers of Earth science, heliophysics, planetary science, and astrophysics.

The Aeronautics Research Mission Directorate (ARMD) transforms aviation with research and generates innovative aviation concepts, tools, and technologies for development and maturation by the aviation community.

The Space Technology Mission Directorate (STMD) pursues transformational technology development, demonstration, and infusion of these technologies into NASA's missions and American industry.

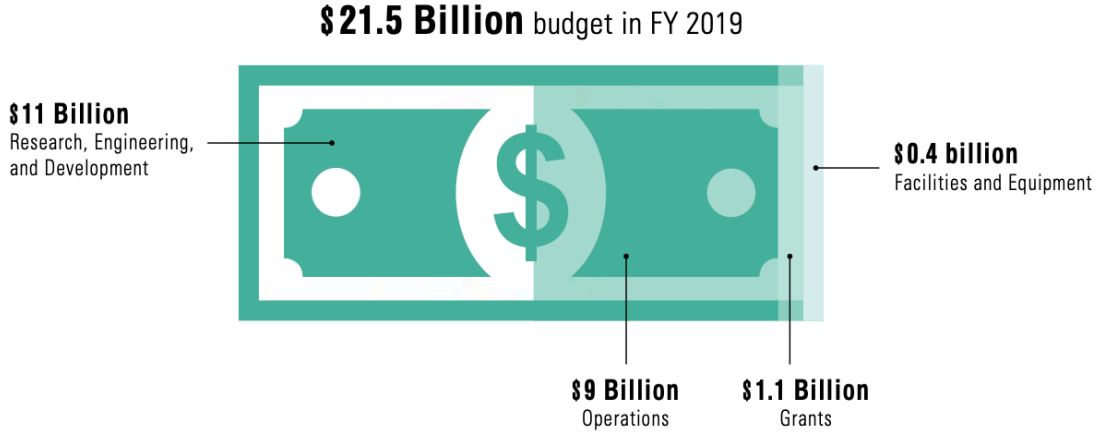
The Human Exploration and Operations Mission Directorate (HEOMD) leads human exploration in and beyond low Earth orbit by developing new transportation systems and performing scientific research to enable sustained and affordable human life outside of Earth.

NASA has 10 field centers and a variety of unique facilities spread across the nation.



[81] 2018 NASA Strategic Plan

More than half of NASA's annual budget goes to research, engineering, and development.



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NASA's ability to explore and discover depends on the integrity of its technical output. The NASA workforce – civil servant, contractors, interns, fellows, and temporary employees – must maintain the highest possible standards of scientific integrity at all times. This obligation extends to the proposing, performing, and reviewing research, and in reporting research results, and to selecting research activities, reviewing publications and proposals, and avoiding actual and perceived conflicts of interest.

NASA's commitment to the responsible conduct of research is apparent in its technical disciplines and is codified in numerous NASA Policy Directives (NPDs) and NASA Procedural Requirements (NPRs). Additionally, NASA is committed to "continuously evaluating, assessing, upholding and enhancing its policies to maintain the highest standard of scientific integrity, now and in the future."[83]

This handbook is designed to augment NASA's many existing resources, including the "NASA Guidelines for Promoting Scientific and Research Integrity." It gives a broad overview of the core elements of the responsible conduct of research, provides NASA-specific and external resources for more information, and lists points of contact for help resolving issues.

[82] FY2019 Agency Financial Report
[83] NASA Guidelines for Promoting Scientific and Research Integrity

Chapter 2: The Responsible Conduct of Research

The research enterprise is built on trust. Researchers must trust the accuracy of their colleagues' work and the public must trust the veracity of research results and stewardship of public funds. This integrity is critical to NASA.

Research Integrity & the Responsible Conduct of Research

There is no formal definition of research integrity, however it can be loosely defined as the adherence to the professional standards of the research community. These standards are based on shared internal values and external obligations and are the foundation of the responsible conduct of research.

There are nine core elements[84] of the responsible conduct of research:

1. Research misconduct;
2. The protection of human subjects;
3. The welfare of laboratory animals;
4. Conflicts of interest in research;
5. Data management practices;
6. Mentor and trainee responsibilities;
7. Collaborative research;
8. Authorship and publication; and
9. Peer review.

These elements, and other considerations are detailed in this handbook.

As a member of the NASA research community – including researchers, supervisors, interns, and support personnel – you are expected to adhere to the internal values[85] of:

- Objectivity
- Honesty
- Openness
- Fairness
- Accountability
- Stewardship

You must also understand your external obligations to:

- The greater research community,

[84] HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research"

[85] National Academies of Sciences, Engineering, and Medicine, Fostering Integrity in Research

    - Researchers depend on each other to produce technically sound data that can be relied upon and used to further scientific discovery.
- Your Institution,
    - Poor research practices reflect badly on the institution (i.e. NASA) and sponsor (i.e. the federal government).
- The public.
    - The public places its trust in the knowledge, skills, and recommendations of researchers' work.
    - Society's support and funding of research are contingent on trusting the results of such research.

Violating the Standards of the Research Community

There are two broad ways the standards of the research community can be violated:

1) Research Misconduct occurs when a researcher deliberately falsifies, fabricates, or plagiarizes information or data during the proposing, performing, or reviewing of research, or in reporting research results. Research misconducted is defined by federal law in 14 CFR 1275.101. See Chapter 3 for more information.

2) Detrimental Research Practices are deviations from the accepted professional practices of the research community and include everything from unfair allocation of credit to harassment. See Chapter 4 for more information.

What drives people to break from accepted professional standards is not always clear. However, there are some known stressors that can prompt poor behavior, including:

- Inadequate training (e.g. 'I didn't know enhancing images could be considered falsification');
- Career and funding pressure (e.g. 'If I don't get this grant [or publish this paper], I'll never get promoted);
- Poor supervision (e.g., 'My boss is unconcerned with day-to-day laboratory operations; I didn't think she'd take me seriously when I said I needed help' or 'My PI is too busy to supervise or review raw data for errors');
- Poor lab culture (e.g. 'The lab manager said we needed to get the experiments finished, no matter what');
- Unclear institutional policies (e.g. 'I didn't know who to talk to about my concerns');
- Personal circumstances (e.g., 'My kid was sick, and I couldn't meet a deadline, so I made data up' or 'I need this job, and I'm worried my boss will fire me if I don't produce the results that he wants'); or

- Individual characteristics or psychology (e.g., laziness, narcissism, or mental illness – 'I just didn't want to run the experiment again, so I made up the results' or 'The initial data supported my hypothesis like I knew it would, so I just didn't run the experiment again).

Researchers and managers should be aware of these stressors so they can identify and combat them in themselves and others.

Ramifications

Any deviation from the shared values of the research community can have significant ramifications. Both research misconduct and detrimental research practices affect:

Individual researchers	Researchers who are accused or found guilty of deviations from accepted practices may face substantial ramifications to their career. For example, colleagues may not want to collaborate with them or submit nominations for awards or promotions; the researcher's future funding prospects may be impacted, either by administrative suspension or debarment, or by loss of trust from colleagues and funders; colleagues may question the validity of past or future work; and institutional management may implement other correction actions.
Institutions	NASA's reputation could be damaged by allowing subpar research to be published, unacceptable behavior by staff, inappropriate working conditions for staff, or for improper stewardship of public funds.
Fields of study	Tainted research results can affect the scientific record for decades after the misconduct is discovered.
Public support/trust	Scandal in the research enterprise can devastate public support of government funded research. Also, the public can lose trust in the results of research.

Additionally, research misconduct has clear administrative consequences. These are listed in 14 CFR 1275.106(a). See Legal & Administrative Consequences for details.

The NASA Office of the Inspector General (OIG) responds to and investigates all allegations of research misconduct. The OIG has final determination on whether or not research misconduct has occurred and what penalties are implemented.

Responsibilities of the NASA Research Community

The NASA workforce must maintain "an environment of trust, built upon honesty, ethical behavior, respect, and candor."[86] Everyone in the NASA research community – civil servants, contractors, interns, researchers, senior leadership, etc. – must understand the role they play in the responsible conduct of research.

The entire NASA community shall:

- Maintain the highest standards of scientific and technical integrity, complying with all applicable Federal laws, Agency directives, and regulations;
- Ensure the integrity and security of NASA's assets against outside (foreign) influence, including NASA's data, hardware, infrastructure, and intellectual property;
- Know, understand, and adhere to ethical guidelines for the conduct of research; and
- Report good-faith suspicions of research misconduct (see Chapter 3) or detrimental research practices (see Chapter 4).

Researchers (all personnel involved in conceiving, designing, conducting and supervising research, including principal investigators, co-investigators, research assistants, post-docs, and interns) have the responsibility to:

- Uphold and embody the professional standards of the research community;
- Exercise personal and professional honesty in proposing, designing, performing research, and reporting research results;
- Maintain mutual respect with all members of the research team and accurately represent the contributions of each member's work; and
- Not allow outside influence or pressure (e.g., political consideration, ideology, financial conflicts of interest, peer pressure, or individual opinion) to affect the results of research, input to or from advisory committees, or the dissemination of research and analysis.

Supervisors, managers, and leaders at every level must:

- Ensure that NASA responds appropriately and quickly to all allegations of research misconduct;
- Support researchers in the responsible conduct of research
- Maintain an environment that encourages ethical research practices and safe reporting practices;
- Ensure the NASA workforce is informed of NASA's policies; and
- Consult with the Center and/or Agency Research Integrity Officer (or Chief Scientist) as needed.

[86] NPD 1000.0 - NASA Governance and Strategic Management Handbook

Resources:

- NASA Guidelines for Promoting Scientific and Research Integrity
- NASA Science Council – Scientific Integrity – August 2018
- NPD 1000.0 - NASA Governance and Strategic Management Handbook
- NPD 1080.1 - Policy for the Conduct of NASA Research and Technology
- NPR 1080.1 – Requirements for the Conduct of NASA Research and Technology
- Institute of Medicine, National Academy of Sciences, and National Academy of Engineering, *"*On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*"*
- National Academies of Sciences, Engineering, and Medicine, Fostering Integrity in Research
- HHS' Office of Research Integrity *"*Introduction to the Responsible Conduct of Research*"*

Chapter 3: Research Misconduct

Definition of Research Misconduct

In 2000, the federal government adopted a uniform definition of research misconduct: “fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results” (14 CFR 1275) This definition applies to all “research wholly or partially funded or supported by NASA appropriated funds, or research involving the use of NASA facilities, equipment, or personnel.”

Research misconduct does not include honest error or differences of opinion. A finding of research misconduct requires that:

1. “There be a significant departure from accepted practices of the relevant research community for maintaining the integrity of the research record;”
2. “The research misconduct be committed intentionally, knowingly, or in reckless disregard of accepted practices; and”
3. “The allegation be proven by a preponderance of evidence.”

Fabrication

Fabrication “means making up data or results and recording or reporting them.”

Falsification

Falsification “means manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.”

Plagiarism

Plagiarism “means the appropriation of another person's ideas, processes, results, or words without giving appropriate credit.”

See Chapter 4 for self-plagiarism

Responsible Office: Office of the Inspector General or Research Integrity Officer

Any allegation of research misconduct brought to the Research Integrity Officer or other POC will be forwarded to the OIG if there is reasonable indication of 1) violation of law; 2) risk to human subjects, animal subjects, or the public; or 3) federally required action

Resources:

- 14 CFR 1275 – Research Misconduct

Legal & Administrative Consequences

The Code of Federal Regulations clearly outlines the administrative actions that can be taken against institutions or individuals who commit research misconduct. They are range from minimal to severe restrictions and are listed in 14 CFR 1275.106(a):

- "Group I Actions.
  - Send a letter of reprimand to the individual or institution.
  - Require as a condition of an award that for a specified period of time an individual, department, or institution obtain special prior approval of particular activities from NASA.
  - Require for a specified period of time that an institutional official other than those guilty of research misconduct certify the accuracy of reports generated under an award or provide assurance of compliance with particular policies, regulations, guidelines, or special terms and conditions.
- Group II Actions.
  - Restrict for a specified period of time designated activities or expenditures under an active award.
  - Require for a specified period of time special reviews of all requests for funding from an affected individual, department, or institution to ensure that steps have been taken to prevent repetition of the research misconduct.
- Group III Actions.
  - Immediately suspend or terminate an active award.
  - Debar or suspend an individual, department, or institution from participation in NASA programs for a specified period of time.
  - Prohibit participation of an individual as a NASA reviewer, advisor, or consultant for a specified period of time."

Responsible Office: NASA Office of the Inspector General

The NASA Office of the Inspector General (OIG) responds to and investigates all allegations of research misconduct. The OIG has final determination on whether or not research misconduct has occurred and what penalties are implemented.

Chapter 4: Detrimental Research Practices

What are Detrimental Research Practices?

Detrimental research practices are actions that violate the professional standards of the research community. These deviations from acceptable practices do not rise to the level of research misconduct (fabrication, falsification, or plagiarism) but could harm researchers' careers, the results of research, and public trust in science.

Detrimental research practices include, but are not limited to:

- Neglecting, exploiting, or harassing subordinates or students. (See Bullying, Harassment, and the Work Environment)
- Inaccurately or unfairly allocating credit in publications or acknowledgements (see Authorship & Publication)
- Intentionally failing to appropriately retain data (see Data Management)
- Failing to maintain the confidentiality or security of sensitive data (see Data Management)
- Publishing incomplete methods and data that impact future reproducibility (see Data Presentation)
- Violating review confidentiality (see Peer Review)
- Intentionally executing experiments with faulty or inadequate scientific design (see Study Design).

The following sections of this chapter give best practices for avoiding common detrimental research practices and give NASA specific resources and points of contact for more information.

Responsible Office: Research Integrity Officer

Resources:

- National Academies of Sciences, Engineering, and Medicine - Fostering Integrity in Research
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research"
- National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition

Authorship & Publication

Authorship

It is critical that the authors listed on a publication be accurate representations of who is responsible for the work. The authors listed on a publication show the research community and the public who conducted the research, who should get the credit, and who is responsible for ensuring the veracity and reliability of the data.

Responsible Authorship Practices

Authorship is reserved to the individuals who made substantial or significant intellectual contributions to the conceptualization, design, execution, supervision, interpretation, or writing the results of the research. Authorship of research publications must not be given to someone who did not substantially contribute to the work. This is called *honorary authorship*. Authorship may not be withheld from someone who was directly involved with or substantially contributed to the work. This is called *ghost authorship*.

Determining who should be listed as an author and in what order can be complex and may be based on the unique standards of a particular research field. The US National Institutes of Health, Office of Intramural Research has produced broad guidelines for determining what types of contributions warrant authorship.

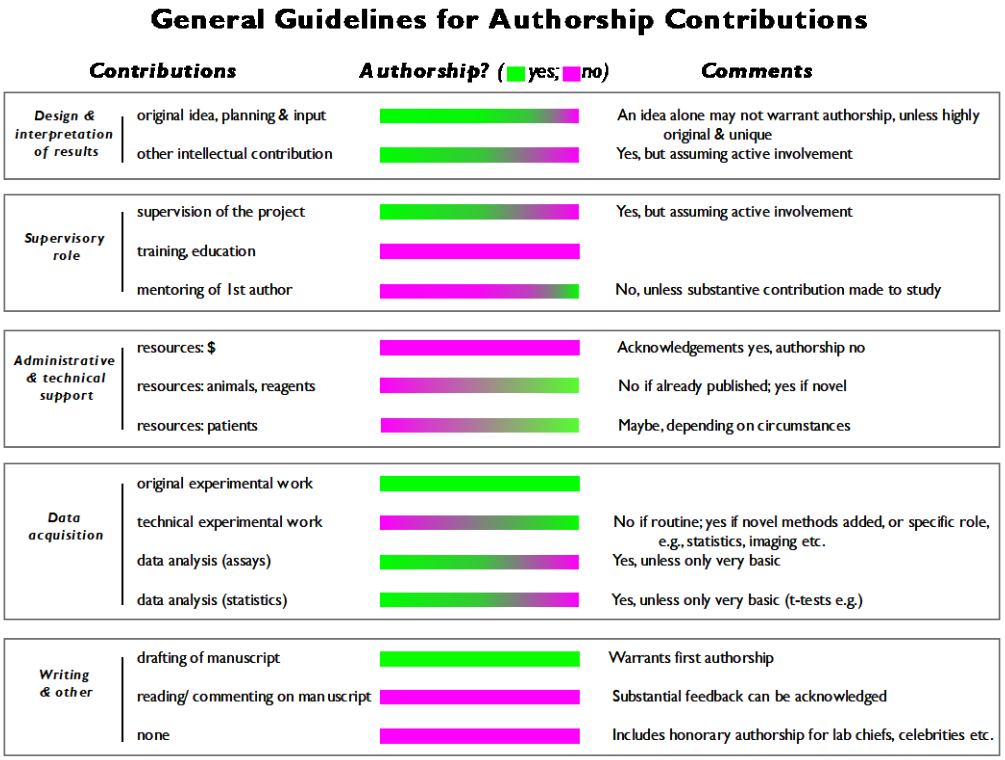


Figure 1: Used with permission. Office of Intramural Research - https://oir.nih.gov/sites/default/files/uploads/sourcebook/documents/ethical_conduct/guidelines-authorship_contributions.pdf

Conflicts in Authorship

Disputes over authorship are common. The risk of disagreement or conflict can be mitigated by open communication between all parties at the beginning of and throughout the research and writing/drafting processes. It is recommended that all members of the research team agree to authorship practices at the beginning of the project.

In the event that authorship disputes cannot be resolved within the research team, the Research Integrity Officer can assist. You may also reach out to your line management (if you are comfortable doing so) or the Ombuds Office.

Responsible Office: Research Integrity Officer

Other Authorship Practices to Avoid

Self-plagiarism

Note: 14 CFR 1275 does not consider self-plagiarism to be research misconduct

Self-plagiarism in research is when an author reuses their own previously published (or disseminated) work without informing the reader that is not *new* work. This is an attempt to deceive the reader. All prior work should be cited properly.

Duplicate (dual) publication

Duplicate publication is when an author submits identical (or nearly identical) work to two or more sources without informing the readers that the work has already been published.

Publication

Why It is Important to Publish Research Results

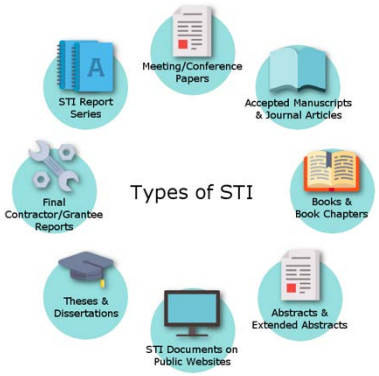
Science is based on collective knowledge – publishing research results contributes to and furthers that knowledge by allowing other researchers to build off of previous study. The National Aeronautics and Space Act requires that NASA "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."[87]

NASA Requirements for Scientific and Technical Information

NASA requires that all scientific and technical information (STI) be released in accordance with federal policy.

[87] National Aeronautics and Space Act of 1958

STI is the results (the analyses of data and facts and resulting conclusions) of basic and applied scientific, technical, and related engineering research and development that is derived from NASA activities. STI includes conference papers, journal articles, abstracts, theses, dissertations, and reports.



All NASA STI will be published, disseminated or presented externally must be reviewed and approved prior to release – *every* time. This includes presentation material that is reused at more than one conference or meeting. Review and approval are done via the NASA Form 1676 Document Availability Authorization (NF-1676 DAA).

Responsible Office: Agency STI Program Office (STIPO)

Website: inside.nasa.gov/sti *Internal access only*

Resources:

- NASA's STI (external) website
- STIPO website – Internal access only
- NASA Publication Guide for Authors
- NPD 2200.1 - Management of NASA Scientific and Technical Information (STI)
- NPD 2230.1 - Research Data and Publication Access.
- NPR 2200.2 - Requirements for Documentation, Approval and Dissemination of NASA. Scientific and Technical Information (STI)
- NASA-Funded Research Results Website
- SATERN Course: NASA Scientific and Technical Information
- OSTP Memorandum: Increasing Access to the Results of Federally Funded Scientific Research
- National Academies of Sciences, Engineering and Medicine: Open Science by Design: Realizing a Vision for 21st Century Research
- National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition, section 'Sharing of Research Results'
- National Aeronautics and Space Act of 1958, 51 U.S.C. § 20101
- HHS' Office of Research Integrity, "Avoiding Plagiarism, Self-plagiarism, and Other Questionable Writing Practices: A Guide to Ethical Writing"

Data Management

Data Acquisition

Every researcher knows that collecting accurate data and meticulously recording it during an experiment is essential to good science. Unreliable data can invalidate the results of the research. False data can be reported or recorded intentionally (which is falsification or fabrication, i.e. research misconduct) or unintentionally due to poor data acquisition or management methods.

Data should be recorded in a 'lab notebook' (either physical or electronic) and should be appropriately labeled per the scientific customs of your field and the requirements of your lab.

Responsible Offices: Research Integrity Officer

If you are comfortable doing so, you may also reach out to your line management or PI.

Resources:

- NIH, "Keeping a Lab Notebook Training"
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 6 Data Management Practices

Records Retention & Data Storage

All NASA employees, including contractors, consultants, interns, and other temporary employees, must adhere to NASA requirements for records retention.

NASA science data should be retained indefinitely.

It is the primary responsibility of the Principal Investigator (PI), research lead, or person responsible for the conduct of the research to ensure that all records from the work/lab are kept and maintained in accordance with NASA and federal policies.

Responsible Office: Research Integrity Officer

The RIO can assist you in resolving conflicts or disputes over data management practices in the research environment. The Office of the Chief Information Officer (OCIO) maintains NASA's retention policies and capabilities. Each Center also has a designated Records Officer who is responsible for ensuring records are properly kept.

Resources:

- NRRS 1441.1 - NASA Records Retention Schedule
- NASA Data Management Plan website
- NASA Plan for Increasing Access to the Results of Scientific Research
- NASA Records Management website
- NPD 1440.6 - NASA Records Management
- NPR 1441.1 - NASA Records Management Program Requirements
- SATERN Course: Federal Records 101, AG-FEDREC-101 – Internal access only
- White paper on NASA science data retention

Data Analysis

All researchers know that data must be analyzed to draw logical conclusions about the study. Best practices include:

- The research team should agree on clear criteria for including or excluding data before they are collected;
- The measurements and observations should speak for themselves (e.g. 'the data show…'). Use scientific and ethical judgement when interpreting the data;
- Do not allow bias – personal or professional preconceived ideas – to influence a researcher's interpretation of data;

  - For example, *confirmation bias* is the tendency to favor data and information that support or further your existing interpretations (over or under emphasizing) and conclusions and can have a detrimental impact on research results.
- Do not allow outside influence or pressure (e.g. political consideration, ideology, financial conflicts of interest, peer pressure, or individual opinion) to affect the results of research, input to or from advisory committees, and the dissemination of research results (see Avoiding Internal & External Influence); and
- Use statistics appropriately or consult a statistician to check the steps of the data analysis, modeling, and interpretation.

Responsible Office: Research Integrity Officer

Resources:
- American Statistical Association (ASA) "Statement on Statistical Significance and P-Values"

Data Presentation

Present data accurately in all publications, presentations, etc.

Images, graphics, or tables should not be manipulated to unduly overstate or understate the importance of the observed data. Modifications that alter the data or interpretation are not acceptable without a clarifying statement – uncited image manipulations may lead to accusations of research misconduct.

Research methods and results should be presented accurately and completely (to the extent feasible) to allow for future reproducibility. Work that cannot be reproduced based on published methods requires additional time and resources from other researchers to prove, disprove, or build off of and can result in the retraction of publications. Proposed work should be designed so that future reproducibility is possible.

Do not unduly overstate or sensationalize findings in an attempt to gain attention from a program or the media. (i.e. let the data speak for itself).

Responsible Office: Research Integrity Officer

Resources:
- NRRS 1441.1 - NASA Records Retention Schedules
- NPD 1440.6 - NASA Records Management
- NPR 1441.1 - NASA Records Management Program Requirements
- NASA's Data Management Plan website
- National Academies of Sciences, Engineering, and Medicine, "Reproducibility and Replicability in Science"

Bullying, Harassment, and the Work Environment

Bullying, Harassment, & the Work Environment

Harassment in the workplace is never acceptable. NASA is committed to maintaining a work environment that is free from harassment, which is "any unwelcome verbal or physical conduct, based on an individuals' race, color, gender, national origin, religion, aged or disability, sexual orientation, status as a parent, genetic information, or gender identity when: (1) the behavior can reasonably be considered to adversely affect the work environment, or (2) an employment decision affecting the employee is based upon the employee's acceptance or rejection of such conduct."[88]

Harassment is a potential violation of civil rights, workplace laws, and NASA policies. It has no place at NASA, and it will not be tolerated. It is the responsibility of all NASA employees and contractors to refrain from engaging in harassing conduct.

Harassment harms researchers, research results, and the work environment. It is a detrimental research practice that negatively impacts the success of NASA's mission and the safety of its workforce by creating an environment that stifles the open exchange of ideas.

Researchers, students, etc. who experience or witness harassment or bullying in the workplace should immediately report the incident(s).

Responsible Offices: Office of Diversity and Equal Opportunity (ODEO) & Office of the Chief Human Capital Officer (OCHCO)

Resources:

- NASA Policy Statement 3713.98 – Anti-Harassment
- NPR 3713.3 – Anti-Harassment Procedures
- NASA Anti-Harassment Policy and Procedures: Frequently Asked Questions
- ODEO's Anti-Harassment website

Mentor/Mentee Relationships

Mentoring is a foundational component of becoming and being a researcher. A mentor guides a mentee on how to conduct good research and build a successful career.

A ***mentor*** is anyone who takes a special interest in helping another person grow their career; this may be a supervisor or established PI but could be any trusted advisor. A mentor does not have to be a formal or official designation.

A ***mentee*** is anyone learning to learning to be a researcher, including an early career scientist, student, post-doc, or new hire.

[88] NPS 3713.98

Mentors are critical in imparting an understanding of the responsible conduct of research, professional standards, the value of integrity, and institution policies. Healthy mentor-mentee relationships are built on positive contributions, respect, trust, and understanding from both parties. Mentor-mentee relationships should be mutually beneficial.

As a mentor, you should:

- Respect your mentee;
- Communicate frequently with your mentee;
- Maintain a productive and supportive research environment;
- Establish clear expectations with your mentee;
- Listen to your mentee's problems, expectations, and concerns;
- Provide clear instructions and constructive feedback;
- Foster the independent professional and intellectual development of your mentee;
- Impart an understanding of the responsible conduct of research and institutional policies;
- Learn from your mentee's experiences, observations, and opinions;
- Be understanding of your mentee's cultural, generational, gender, or other background differences;
- Establish a mutually beneficial and appropriate working relationship with your mentee; and
- Not abuse your authority.

As a mentee, you should:

- Respect your mentor;
- Communicate with your mentor frequently, especially when problems arise;
- Ask questions;
- Learn from your mentor's experience;
- Perform assigned work in a conscientious way;
- Follow all research regulations and protocols; and
- Establish a mutually beneficial and appropriate working relationship with your mentor.

Conflicts between mentors and mentees can arise and include:

- Inappropriate or unclear allocation of credit (i.e. authorship);
- Unclear division of work or misunderstanding of expectations;
- Poor supervision of mentee's work or professional development;
- Conflicting cultural, generational, gender, or other background differences;
- Inappropriate working relationships or harassment.
    - *Harassment between mentors and mentees (or anyone else) is never acceptable and will not be tolerated at NASA. Anyone who experiences or witnesses harassment or bullying in the workplace should immediately report the incident(s) to ODEO or OCHCO.*

Clear and frequent communication between parties can alleviate many of these disagreements. However, your line management, the Ombuds Office, or the Research Integrity Officer can assist in resolving conflicts if needed.

Responsible Offices: Research Integrity Officer or Ombuds Office
Contact the Office of Diversity and Equal Opportunity or the Office of the Chief Human Capital Officer to report harassment.

Resources:
- ODEO's Anti-Harassment website
- Institute of Medicine, National Academy of Sciences, and National Academy of Engineering, "Adviser, Teacher, Role Model, Friend - On Being a Mentor to Students in Science and Engineering"
- National Academies of Sciences, Engineering, and Medicine, "The Science of Effective Mentorship in STEMM"
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 7, Mentor and Trainee Responsibilities

Conflicts of Interest in Research

What are Conflicts of Interest in Research?

'Conflicts of Interest in Research' refers to situations in which financial or personal circumstances may compromise, or appear to compromise, a researcher or reviewer's professional judgement and objectivity in conducting, reporting the results of, or reviewing research. It is critical that the NASA workforce avoid conflicts of interest and their appearance in research.

Potential conflicts of interest can happen at any stage in the research process, including during the development or writing of a proposal, the designing or execution of experiments, publishing data or results, or reviewing publications or proposals.

Some examples of conflict of interest in research are:
- Possible financial gain or stake from the work;
- Having family or employment ties with the proposers, reviewers, or authors;
- Reviewing the work of a current or former collaborator; or
- Having a strong personal bias for or against a proposer or author.

The NASA workforce must avoid actual or perceived conflicts of interest in research. If you have a conflict, you should report it to the appropriate party (e.g. the review committee for a journal article) and/or with NASA legal counsel, as needed (see Financial Conflicts of Interest).

Contractor employees should refer to their company for additional information and requirements.

Responsible Offices: Research Integrity Officer, Designated Agency Ethics Official (Office of the General Counsel), Center Ethics Contact

The Designated Agency Ethics Official and Center Ethics Contact can assist with legal & financial conflicts of interest.

Resources:

- SATERN Course: Ethics for NASA Employees
- 18 USC 201-209
- 5 CFR 2635, Standards of Ethical Conduct for Employees of the Executive Branch
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 5, Conflicts of Interest

Financial Conflicts of Interest

NASA civil servant employees are prohibited by a federal criminal statute from working on matters that could benefit the personal interests of the employee or someone close to them. These matters compromise the objectivity of the NASA employee. For purposes of this rule, an employee is responsible for the financial interests of:

1. the employee
2. the employee's spouse or minor child
3. the employee's general partner
4. an organization in which the employee serves as an officer, director, trustee, general partner or employee
5. a person with whom the employee is negotiating for or has an arrangement concerning prospective employment.

After consulting with the Office of Government Ethics (OGE) or the Office of the Chief/General Counsel, financial conflicts of interested *may* be resolved by:

- Recusal – where the conflicted employee does not participate in the matter
- Divestment – where a personal financial interest is sold
- Waiver – where an individual waiver is granted per 5 CFR 2640.

Consult with the Office of the Chief/General Counsel
if you think you have a conflict of interest in any area

NASA civil servant employees are subject to limitations on their outside activities, especially those that conflict with official duties, per 5 CFR 6901. Employees may not be paid for *any* outside work (e.g., teaching, speaking, or writing related to NASA activities) or use their official titles (except as part of a biography or for identification) for outside activities, without advanced approval.

Responsible Offices: Designated Agency Ethics Official (Office of the General Counsel) or Center Ethics Contact

Resources:

- NPR 1900.9 - Ethics Program Management Procedures Requirement

- NASA Ethics Program website
- Center Ethics Contacts website
- 18 USC 201-209, 216
- 5 CFR 2635
- 5 CFR Part 6901
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 5, Conflicts of Interest

Human Subject Research

NASA uses human research subjects for a variety of reasons including understanding the effects of aerospace conditions, factors, and environments.

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains (1) Data through intervention or interaction with the individual, or (2) Identifiable private information. – 14 CFR 1230, "The Common Rule"

Per NASA policy, researchers must ensure the welfare of human subjects and conduct research with minimal health risk. The NASA Institutional Review Board (IRB) reviews all research involving human subjects to ensure the ethical, safe, and equitable treatment of the research subjects.

All investigators who conduct research that falls within the purview of "The Common Rule" must complete a prescribed training course. This course is provided at no cost to NASA Centers through the CITI program, https://www.citiprogram.org/

Successful completion of either one of the following two course will satisfy the requirement. However, it is recommended (not mandatory nor monitored) that the investigator complete both programs:

1. Biomedical Sciences, and/or
2. Behavioral and Social Sciences

NASA is guided by the "The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research." Per the Report, there are three basic ethical principles to research involving human subjects:

1. *Respect for Persons*: "individuals should be treated as autonomous agents, and…persons with diminished autonomy are entitled to protection." All research subject must completely understand what is to be done and all potential risks and benefits. The subject must freely give consent to participate in the study.
2. *Beneficence*: "**(1)** do not harm and **(2)** maximize possible benefits and minimize possible harms." All research with human subjects must weigh the benefit to the subject with the risk.
3. *Justice*: "**(1)** to each person an equal share, **(2)** to each person according to individual need, **(3)** to each person according to individual effort, **(4)** to

each person according to societal contribution, and **(5)** to each person according to merit." The risks and potential benefits of research should be spread fairly among subjects and subject groups.

NASA researchers who use human subjects must adhere to all federal and agency requirements. Visit the IRB website for more information: www.irb.nasa.gov

Responsible Office: Office of the Chief Health & Medical Officer (OCHMO), Chair of the IRB, Research Integrity Officer

Resources:

- 14 CFR Part 1230 - Protection of Human Subjects
- NPD 7100.8 - Protection of Human Research Subjects
- NPD 7170.1 - Use of Human Research Genetic Testing
- NPR 7100.1 - Protection of Human Research Subjects
- NASA's Office of the Chief Heath & Medical Officer's Website
- NASA's Institutional Review Board website
- The Belmont Report
- The Nuremberg Code
- The Declaration of Helsinki
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 3, The Protection of Human Subjects

Animal Subject Research

Animal research plays a critical role in much of the research NASA does. NASA adheres to the three ethical principals in the Sundowner Report:

1. *Respect for Life* - Living creatures deserve respect. Animals used in research should be of an appropriate species and health status, and the research should involve the minimum number of animals required to obtain valid scientific results.
2. *Societal Benefit* – When animals subjects must be used, the overall ethical value of such use should be weighed against the potential benefit to society, the affected populations, and the risk and burden borne by the animals.
3. *Nonmaleficence* - Vertebrate animals are sentient. It is a moral imperative that distress, pain, and suffering be minimized.

Responsible Offices: Office of the Chief Health & Medical Officer, Office of the Chief Veterinarian, Chair of the Ground IACUC (center level), Chair of the Flight IACUC (agency level), Research Integrity Officer

Resources:

- The Sundowner Report
- 14 CFR 1232 – Care and Use of Animals in the Conduct of NASA Activities
- Animal Welfare Act of 1966
- 7 U.S.C 2131

- NPD 8910.1 - Care and Use of Animals
- NPR 8910.1 - Care and Use of Animals
- Johnson Space Center's Animal Care and Use Handbook
- Flight Institutional Animal Care and Use Committee Charter – Internal access only
- Animal Policy Review Board Charter – Internal access only
- Animal Care and Use Policy Implementation – Internal access only
- NASA ARC's lecture Animals in NASA Research: Ethical, Regulatory & biological Challenges
- National Research Council, Guide for the Care and Use of Laboratory Animals

Study Design

Good research requires a sound study design and experiment/test protocol. The study's design must address all the relevant variables and have appropriate experimental groups and controls. A faulty design compromises the integrity of the data, results, interpretations, and conclusions.

Responsible Office: Research Integrity Officer
You may also reach out to your mentor or line management if you are comfortable doing so.

Collaborative Research

Collaboration is increasingly common in almost all technical fields. Collaboration is particularly critical to NASA's mission and vision. NASA regularly partners with other federal departments and agencies, the U.S. private sector, non-profit organizations, universities, and foreign space agencies to coordinate, develop, and implement mutually beneficial cooperative space working groups, programs, projects, missions, and ground-based research activities.

Collaborative agreements between NASA and other institutions or agencies are primarily done through reimbursable or non-reimbursable Space Act Agreements under the National Aeronautics and Space Act (other partnering authorities include the Commercial Space Launch Act and the Economy Act). To establish a collaboration, contact your center's Office of Strategic Partnerships.

In collaborative projects, researchers assume additional responsibilities stemming from the unique challenges of collaboration, including:

- Complex roles and relationships between partnering researchers,
- Management requirements from home institutions,
- Similar, but individual, interests of partnering researchers and institutional goals, and
- Cultural differences, particularly communication style.

Effective collaboration requires clear communication and mutual understanding of the roles, responsibilities, and goals of the project. It is a best practice to ensure mutual understanding before a project begins on topics such as how data

will be collected, stored and shared; how changes in research design will be made; and criteria for and the order of authorship.

Early communication can head off most problems, but sometimes issues arise. If you encounter instances of research misconduct or detrimental research practices, contact the Research Integrity Officer.

Recommended Point of Contact: Your line management

The responsible office will depend on the type of collaboration. It could be the granting mission directorate POC (e.g. STMD), your center's Office of Strategic Partnerships, or the Office of International and Interagency Relations. If you do not know who to contact, reach out to your line management or the Research Integrity Officer.

Resources:

- NASA's Partnerships website
- NASA Partnerships Community of Practice – Internal access only
- SATERN Course: Explore Partnerships (Modules 1-6), AG-PART-101-M01 – Internal access only
- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 8, Collaborative Research
- National Research Council, "Overcoming Barriers to Collaborative Research"
- National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, "Examining Core Elements of International Research Collaboration: Summary of a Workshop"
- National Academies, "Culture Matters: International Research Collaboration in a Changing World: Summary of a Workshop"
- * National Research Council, "International Collaborations in Behavioral and Social Sciences: Report of a Workshop"
- * National Research Council, "Building Infrastructure for International Collaborative Research in the Social and Behavioral Sciences: Summary of a Workshop"

  * While these reports focus on social sciences, they contain useful information about collaborative research

Peer Review

Peer review is essential to science. The evaluation of technical work by experienced colleagues is utilized for reviewing technical proposals and manuscripts; making personnel decisions, including hiring, promoting, or grant merit awards; and ensuring the quality and reliability of research.

NASA researchers who serve as peer reviewers must understand the important role it plays in the research community and adhere to the following tenets:

Meet deadlines	Peer reviewers must balance competing priorities and meet their obligations in a timely manner.
Avoid personal bias	Do not allow personal feelings to influence the review of another researcher's work.

	Accurately report all conflicts of interest or personal biases for or against the reviewee.
Respect confidentiality	Some of the information shared with peer reviewers is confidential and may not be shared without permission (e.g., ask someone else to review a proposal for you or discuss a proposal with a colleague). Confidentiality helps protect ideas and personal privacy.

Peer review is also essential for assessing the quality of proposed and published research. Peer reviewers may be asked to judge the appropriateness of the research methods, check calculations, confirm the logic of arguments or conclusions, confirm the accuracy of literature reviews, and/or assess whether the work conforms to accepted research practices.

Responsible Office: Research Integrity Officer

Resources:

- HHS' Office of Research Integrity "Introduction to the Responsible Conduct of Research" Chapter 10, Peer Review

Chapter 5: Additional Considerations

Avoiding Internal & External Influence

Researchers must not allow internal bias or external pressure to influence the design, proposing, or conduct of research, nor the reporting of research results.

Internal influences are personal or professional preconceived ideas that can influence a researcher's interpretation of data. For example, *confirmation bias* is the tendency to favor data and information that support or further your existing interpretations (over or under emphasizing) and conclusions and can have a detrimental impact on research results.

Organizational influence can also negatively impact research quality. For example, researchers may compromise the validity of their conclusions with inappropriate data analyses in a rush to meet deadlines or meet their management's expectations or to move to a new, exciting project.

Researchers should not allow *external influences* or pressures (e.g. political consideration, ideology, financial conflicts of interest, peer pressure, or individual opinion) to affect the results of research, input to or from advisory committees, and the dissemination of research results.

NASA civil servants and contractors must avoid unauthorized *foreign influence.* Foreign governments and adversaries often target NASA to unlawfully acquire sensitive U.S. technologies and information. NASA employees must protect national security by reporting any behavior or incident that may relate to a potential compromise of classified, sensitive, or export-controlled information. All NASA employees must conduct a pre- and post-foreign travel debrief with their center's Counterintelligence Special Agent, all collaborations with foreign entities must be authorized, and employees must adhere to all guidelines for designated countries.

Responsible Office: Research Integrity Officer, NASA Counterintelligence, Office of International and Interagency Relations

References:

- NPR 1660.1C - NASA Counterintelligence and Counterterrorism (internal access only)
- Designated countries list

Export Control

NASA is on the leading edge of technological development and various scientific endeavors. Much of NASA's advanced technology and hardware is regulated by U.S. export control laws and regulations and is required to be reviewed and approved prior to release. All NASA employees have a responsibility to adhere to export control laws and regulations and follow NASA requirements.

An *export* is the transfer of anything (e.g., software, technical data, hardware, or providing technical assistance) to a foreign person or a foreign destination by any means, anywhere, at any time. Exports can take place by:

- Verbal discussion or presentation to a foreign person
- Electronic transmission by any means, including email or telephone
- Releasing information publicly via a website or social media
- Shipping (mailing) items
- Hosting foreign visitors at NASA facilities
- Hand carrying information outside the U.S., including on your laptop or cellphone

Export controls are restrictions applied by the U.S. government to the transfer of certain goods, services, software, technical data, and technology to foreign entities. These laws and regulations protect U.S. national security and policy interests.

The primary U.S. Government regulators for NASA are:

1. The Department of State (DOS), which administers *International Traffic in Arms Regulations* (ITAR)
2. The Department of Commerce (DOC), which administers the *Export Administration Regulations* (EAR)

The **ITAR** controls the export of goods and technical data that are principally used in military or intelligence applications. These items are identified on the United States Munitions List (USML).

Among the 21 categories on the USML, NASA commonly handles the following articles and defense services:

- Space launch vehicles (IV)
- Sounding rockets (IV)
- Propellants (V)
- Aircraft (VIII)
- Spacecraft (XV)
- Sensors (XI, XII, XIII)
- Guidance navigation and control systems (XII)

The **EAR** controls goods and technologies that have civil, commercial, military, and intelligence applications. These items are identified on the Commerce Control List (CCL).

Among the 10 categories on the CCL, NASA commonly handles the following:

- Electronics (3)
- Computers (4) **note, all NASA computers and cell phones require an export authorization for travel to a foreign destination*
- Telecommunications (5 Part 1)
- Sensors and Laser (6)
- Navigation and Avionics (7)
- Aerospace and Propulsion (9)

If an item is listed on the USML or the CCL,
an export authorization/determination is required.

Penalties for failing to comply with export control calls can result in:

- NASA administrative disciplinary actions
  - Work restrictions, fines, and/or demotions
  - Employment termination
- ITAR/EAR civil and/or criminal penalties
  - Monetary penalties can be as much as $1 million per violation.
  - Incarceration can be for a period up to 20 years.

Responsible Office: Office of International and Interagency Relations, Export Control Officer (center level)

Resources:

- NAII 2190.1 - NASA Export Control Program Operations Manual
- NASA's Export Control website – Internal access only
- NASA Export Control Training Workshop – Internal access only
- NPR 2190.1 - NASA Export Control Program
- NPD 2190.1 - NASA Export Control Program

- SATERN Course: NASA Export Control Awareness Training, AG-ECP-001 – Internal access only
- SATERN Course: Export Control Management Awareness Training, HQ-NASA-EXPCONT – Internal access only

Laboratory Safety

Safety is one of NASA's core values. Any research laboratory environment is a hazardous place to work. Lab workers face potential exposure to chemical, biological, physical, and radioactive hazards.

NASA follows OSHA Laboratory Standards (29 CFR 1210.1450). Everyone in the lab must work to develop a culture of safety consciousness, accountability, and organization with teamwork and personal responsibility. Lab workers must:

- Follow all lab, state, and federal safety regulations;
- Be familiar with the hazards associated with their lab;
- Complete all mandatory training for their lab;
- Wear appropriate personal protective equipment;
- Know required emergency, clean up, and first aid procedures; and
- Know appropriate reporting mechanisms for raising concerns.

Accidents in the lab can cause serious injury or death. If something isn't safe: **IMMEDIATELY STOP WORK AND REPORT THE INCIDENT** to your supervisor, your center official, Headquarters, the NASA Safety Reporting System, or emergency services.

REMEMBER - IF IT'S NOT SAFE, SAY SO!

Report concerns anonymously: https://sma.nasa.gov/sma-disciplines/nsrs

Responsible Office: Office of Safety and Mission Assurance

The Research Integrity Officer can assist if needed. You may also reach out to the lab's manager, your PI, or your line management if you are comfortable doing so.

Resources:

- NASA Safety and Hazard Reporting website (includes center level POCs)
- NPR 1800.1 - NASA Occupational Health Program Procedures
- NPR 8715.3 - NASA General Safety Program Requirements
- NPR 8705.6 - Safety and Mission Assurance (SMA) Audits, Reviews, and Assessments
- NASA Safety Center's Lab Safety Website
- Lab Safety Onboarding Checklist
- PowerPoint presentation: 2020 NASA Chemical Lab Safety Campaign
- SATERN Course: Laboratory Safety & Health, SMA-HQ-WBT-311 – Internal access only
- SATERN Course: Orientation to NASA Safety Culture, HQ-SMA-ONSC – Internal access only
- SATERN Course: Safety Culture for Supervisors, HQ-SMA-SCS – Internal access only
- 29 CFR 1903.1, OSHA Act
- Institute of Medicine, National Academy of Sciences, and National Academy of Engineering, "On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition" section: Laboratory Safety in Research
- National Research Council, "Prudent Practices in the Laboratory Handling and Management of Chemical Hazards"

Hiring Practices

NASA is committed to strengthening the actual and perceived credibility of government research by ensuring that scientific positions at NASA are filled based on merit. Candidates for positions are evaluated on the basis of their scientific and technological knowledge, credentials, experience, and integrity.

NASA will use competitive practices for external hiring that fairly test the relative capacity and fitness of candidates for the jobs to be filled and to support selection from among the best-qualified candidates. Internal positions will be filled through competition and on the basis of merit. These criteria ensure that preeminent talent is recruited and retained to staff and lead the research programs of the agency.

Responsible Office: Office of the Chief Human Capital Officer

Resources:

- NPR 3335.1 - Internal Placement of NASA Employees
- 5 CFR 300.102, Employment Practices

Chapter 6: Reporting Concerns

The Importance of Reporting

Everyone in the NASA community has the responsibility to report good-faith concerns of research misconduct (i.e., falsification, fabrication, or plagiarism) or detrimental research practices.

Failure to report can lead to:

- "Serial misconduct" – building a career on a sustained history misconduct;
- A poor work environment and loss of morale leading to researchers believing that such behavior will continue without consequence;
- Poor institutional quality and reputation; and/or
- Stunted professional careers of affected colleagues.

Many people can be hesitant to report given the severity of the possible consequences (see Ramifications). For example:

- People worry that if they are wrong, they will damage the reputation of their colleagues;
- People are afraid that if a collaborator is accused it will reflect badly on their own work;
- People don't believe their institution will adequately address the issue or correct the behavior, or they fear retaliation; or
- Junior staff don't want to question senior staff.

It is unlawful for your employer to retaliate against you for making a "protected disclosure" (see Whistleblower Protection for more information).

When to Report

You must report all good faith allegations of research misconduct or detrimental research practices. An allegation is made in "good faith" when it is made with the honest belief that misconduct has (or may have) occurred. An allegation is made in 'bad faith' when it is "made with reckless disregard for or willful ignorance of facts that would disprove the allegation."[89]

Collect all relevant evidence (if any) and bring it with you when you report your concern. This will help the reporting official better respond to your concern. **Confronting the accused is not recommended**.

[89] https://ori.hhs.gov/complainant

The Research Integrity Officer should be your main point of contact for all issues regarding the responsible contact of research. The RIO will work with you to approach the appropriate POC if needed.

Office of the Inspector General

Every Federal agency has an independent Office of Inspector General (OIG) charged with conducting objective audits and investigations, as well as preventing and detecting fraud, waste, and abuse. The NASA OIG Office of Investigations handles allegations in which NASA is the potential victim of fraud, waste, or abuse by employees, grantees, contractors, or others, including research misconduct.

OIG Investigations
Allegations of research misconduct that that meet the criteria laid out in 14 CFR 1275.101(a) and are made to the OIG involving NASA researchers are handled in accordance with 14 CFR 1275.

Allegations of research misconduct brought to other points of contact (e.g., the RIO, Ombuds, or line management) must be forwarded to the OIG if there is reasonable indication of 1) violation of law; 2) risk to human subjects, animal subjects, or the public; or 3) federally required action.

You can contact the OIG on its website or hotline – 1-800-424-9183

The OIG must inform the agency Chief Scientist of all allegations that meet the definition of research misconduct. The Chief Scientist shall notify the NASA Office of the Chief Engineer and Office of the Chief Technologist if the research is either engineering or technology research.

Research Integrity Officer

The RIO is the designated point of contact to handle all issues related to the responsible conduct of research. Center RIOs are specifically trained to adjudicate conflicts related to the proposing, performing, or reviewing research, or reporting of research results.

RIOs have the authority to investigate and enforce resolutions to issues brought to their attention. For example:

- In authorship disputes, the RIO will do everything possible to have the involved parties reach an agreement. If an agreement cannot be reached, the RIO may stop the approval of the NF-1676; convene a panel of internal experts to review the evidence and make a determination on authorship, or make the determination themselves; inform each party's

line management or other third party stakeholders (e.g., collaborators, journal editors) of the dispute and decision.

Any allegation brought to the Research Integrity Officer will be promptly forwarded to the OIG if there is reasonable indication of 1) violation of law; 2) risk to human subjects, animal subjects, or the public; or 3) federally required action. The NASA OIG investigates all claims of research misconduct brought to its attention.

Other Points of Contact (POCs)

Office of General Counsel & Office of Chief Counsel
The Office of the General Counsel (OGC) provides functional leadership regarding legal services and issues related to all aspects of NASA activities. Each Center has an Office of the Chief Counsel (OCC) to assist with Center-level concerns. The OGC/OCC can assist with any research integrity matter than involves a legal concern, including procurement, export control, security, ethics, conflicts of interest, and more.

www.nasa.gov/offices/ogc/

Ombuds Office
The NASA Ombuds Program is an informal, independent, confidential, and neutral means of communicating and facilitating the resolution of safety, organizational performance, and mission related issues without fear of retaliation. All NASA Centers and the Jet Propulsion Laboratory have Ombuds who will listen to an employee's issues, explore options, and weigh the pros and cons of various options for resolution.

Ombuds are available to help clarify an issue, facilitate a discussion between individuals, and refer to formal resources. They **do not** replace or supersede formal reporting mechanisms.

www.nasa.gov/offices/ombuds

Office of the Chief Human Capital Officer (OCHCO)
The Office of the Chief Human Capital Officer manages and administers human resource activities for each NASA center. OCHCO is responsible for hiring, retention, and promotion practices. OCHO staff can also help resolve workplace disputes.

https://hr.nasa.gov (internal access only)

Office of the Chief Health and Medical Officer (OCHMO)
The NASA Chief Health and Medical Officer is responsible for policy and oversight of all health and medical activities at NASA including research involving human or animal research subjects.

https://www.nasa.gov/offices/ochmo/

Office of Diversity and Equal Opportunity (ODEO)
ODEO manages the diversity and civil rights policies, programs, and services at NASA. ODEO personnel can assist you in resolving complaints of harassment, bullying, or discrimination.

https://www.nasa.gov/offices/odeo/home

Institutional Review Board (IRB)
The NASA IRB operates under federal regulations to ensure the ethical, safe, and equitable treatment of human research subjects. All research with human subjects must be approved and reviewed by the IRB.

irb.nasa.gov

Ground & Flight Institutional Animal Care and Use Committees (IACUCs)
The Ground IACUC (center-level) and Flight IACUC (agency-level) operate under federal regulations to protect the welfare of animal research subjects. All research with animal subjects must be approved and reviewed by the IACUC.

IACUC website: an agency wide IACUC website is in development. This handbook will be updated once the URL is available.

Office of International and Interagency Relations (OIIR)
OIIR provides executive leadership and overall policy coordination for all of NASA's international projects and is responsible for drafting, negotiating, executing, amending, terminating, and providing oversight of international agreements. OIIR is responsible for the review of all NASA interagency agreements (IAAs), including the coordination and tracking of all classified IAAs.

https://www.nasa.gov/oiir

Whistleblower Protection

NASA policy and federal law require any employee who observes a crime, misconduct, or mismanagement to report it to the NASA OIG.

It is unlawful for your employer to retaliate against you for making a "protected disclosure." A disclosure is protected if it meets two criteria:

1. The disclosure must be based on a reasonable belief that wrongdoing has occurred. As explained in the chart below, the definition of wrongdoing varies slightly depending on your place of employment.
2. The disclosure must also be made to a person or entity that is authorized to receive it. Employees who reasonably believe they have evidence of wrongdoing are always protected for submitting that information to the OIG Hotline or your local OIG office. However, as explained in the chart below, the other authorized audiences are different, depending on your employment status.

Status	Wrongdoing Defined	Authorized Audiences
NASA Employees	- Violation of any law, rule or regulation; - Gross mismanagement; - Gross waste of funds; - Abuse of authority; and - Substantial and specific danger to public health or safety - Censorship related to scientific research, analysis, or technology (scientific integrity)	In general, employees may disclose information to anyone, including non-governmental audiences, unless the information is classified or specifically prohibited by law from release. However, if the information is classified or specifically prohibited by law from release, it may only be shared with the OIG, OSC, or a designated agency official.
Contractors, Subcontractors, Grantees, Sub-grantees, and Personal Services Contractors	- Gross mismanagement of a Federal contract or grant; - Gross waste of Federal funds, - Abuse of authority relating to a Federal contract or grant, - Substantial and specific danger to public health or safety, or - Violation of law, rule, or regulation related to a NASA contract (including the competition for or negotiation of a contract) or grant.	For all disclosures, classified or unclassified, an employee of a contractor or grantee is only protected if the disclosure is made to: A. A Member of Congress or a representative of a committee of Congress. B. An Inspector General. C. The Government Accountability Office. D. A NASA employee responsible for contract or grant oversight or management at the relevant agency. E. An authorized official of the Agency or the OIG. F. A court or grand jury. G. A management official or other employee of the contractor, subcontractor, grantee, sub-grantee; or manager of a personal services contractor who has the responsibility to investigate, discover, or address misconduct.

Responsible Office: Office of the Inspector General

Resources:
- Office of the Inspector General's website
- Office of Special Counsel's website
- SATERN Course: No FEAR Act – Internal access only
- Notification and Federal Employee Antidiscrimination and Retaliation Act of 2002
- 5 U.S.C. 2302(b)(8) - Prohibited Personnel Practices

Chapter 7: Resources

Points of Contact

An up-to-date list of all of the points of contact listed in this handbook can be found at: www.nasa.gov/ames/ocs/rcr

Resources

The table below contains every resource listed in this handbook. You can also find this list at: www.nasa.gov/ames/ocs/rcr

Title	Author	Topic
14 CFR 1232 – Care and Use of Animals in the Conduct of NASA Activities	Code of Federal Regulations	Animal Subjects Research
14 CFR 1275 – Research Misconduct	Code of Federal Regulations	Research Misconduct
14 CFR Part 1230 - Protection of Human Subjects		Human Subjects Research
18 USC 201-209, 216	United States Code	Financial COI
29 CFR 1903.1, OSHA Act	Code of Federal Regulations	Lab Safety
5 CFR 2635	Code of Federal Regulations	Financial COI
5 CFR 300.102, Employment Practices	Code of Federal Regulations	Hiring Practices
5 CFR 6901, Supplemental Standards of Ethical Conduct for Employees of the National Aeronautics and Space Administration	Code of Federal Regulations	Conflicts of Interest – outside activities
5 U.S.C. 2302(b)(8) - Prohibited Personnel Practices	United States Code	Whistleblower Protection
51 U.S.C. 20101, National Aeronautics and Space Act of 1958	United States Code	NASA
7 U.S.C 2131	United States Code	Animal Subjects Research

Adviser, Teacher, Role Model, Friend - On Being a Mentor to Students in Science and Engineering	Institute of Medicine, National Academy of Sciences, and National Academy of Engineering	Mentoring
Animal Care and Use Policy Implementation – internal access only	NASA	Animal Subjects Research
Animal Policy Review Board Charter – internal access only	NASA	Animal Subjects Research
Animal Welfare Act of 1966	NASA	Animal Subjects Research
Avoiding Plagiarism, Self-plagiarism, and Other Questionable Writing Practices: A Guide to Ethical Writing	HHS' Office of Research Integrity	Publication, Authorship, Writing
Building Infrastructure for International Collaborative Research in the Social and Behavioral Sciences: Summary of a Workshop	National Research Council	Collaborative Research
Center Ethics Contacts website	NASA	Financial COI
Culture Matters: International Research Collaboration in a Changing World: Summary of a Workshop	National Academy of Sciences, National Academy of Engineering, and Institute of Medicine	Collaborative Research
Designated Countries List	NASA	Foreign Influence
Examining Core Elements of International Research Collaboration: Summary of a Workshop	National Academy of Sciences, National Academy of Engineering, and Institute of Medicine	Collaborative Research
Flight Institutional Animal Care and Use Committee Charter – internal access only	NASA	Animal Subjects Research
Fostering Integrity in Research	National Academies of Sciences, Engineering, and Medicine	Responsible Conduct of Research
Guide for the Care and Use of Laboratory Animals	National Research Council	Animal Subjects Research

International Collaborations in Behavioral and Social Sciences: Report of a Workshop"	National Research Council	Collaborative Research
Introduction to the Responsible Conduct of Research	HHS' Office of Research Integrity	Responsible Conduct of Research
Johnson Space Center's Animal Care and Use Handbook	NASA	Animal Subjects Research
Keeping a Lab Notebook Training	NIH	Data Management
Lab Safety Onboarding Checklist	NASA	Lab Safety
Memorandum: Increasing Access to the Results of Federally Funded Scientific Research	OSTP	Publication
NAII 2190.1 - NASA Export Control Program Operations Manual	NASA	Export Control
NASA Anti-Harassment Policy and Procedures: Frequently Asked Questions	NASA	Harassment
NASA ARC's lecture Animals in NASA Research: Ethical, Regulatory & biological Challenges	NASA	Animal Subjects Research
NASA Data Management Plan website	NASA	Data Management
NASA Ethics Program website	NASA	Financial COI
NASA Export Control Training Workshop – Internal access only	NASA	Export Control
NASA Guidelines for Promoting Scientific and Research Integrity	NASA	Responsible Conduct of Research
NASA Partnerships Community of Practice – Internal access only	NASA	Collaborative Research
NASA Plan for Increasing Access to the Results of Scientific Research	NASA	Data Management
NASA Policy Statement 3713.98 – Anti-Harassment	NASA	Harassment
NASA Publication Guide for Authors	NASA	Publication

NASA Records Management website	NASA	Data Management
NASA Safety and Hazard Reporting website (includes center level POCs)	NASA	Lab Safety
NASA Safety Center's Lab Safety Website	NASA	Lab Safety
NASA-Funded Research Results Website	NASA	Publication
NASA's Data Management Plan website	NASA	Data Management
NASA's Export Control website – Internal access only	NASA	Export Control
NASA's Institutional Review Board website	NASA	Human Subjects Research
NASA's Office of the Chief Health & Medical Officer's Website	NASA	Human Subjects Research
NASA's Partnerships website	NASA	Collaborative Research
NASA's STI (external) website	NASA	Publication
Notification and Federal Employee Antidiscrimination and Retaliation Act (No FEAR Act) of 2002	NASA	Whistleblower Protection
NPD 1000.0 - NASA Governance and Strategic Management Handbook	NASA	NASA
NPD 1080.1 - Policy for the Conduct of NASA Research and Technology	NASA	Responsible Conduct of Research
NPD 1440.6 - NASA Records Management	NASA	Record Retention
NPD 1440.6 - NASA Records Management	NASA	Record Retention
NPD 2190.1 - NASA Export Control Program	NASA	Export Control
NPD 2200.1 - Management of NASA Scientific and Technical Information (STI)	NASA	Publication
NPD 2230.1 - Research Data and Publication Access.	NASA	Publication
NPD 7100.8 - Protection of Human Research Subjects	NASA	Human Subjects Research

NPD 7170.1 - Use of Human Research Genetic Testing	NASA	Human Subjects Research
NPD 8910.1 - Care and Use of Animals	NASA	Animal Subjects Research
NPR 1080.1 – Requirements for the Conduct of NASA Research and Technology	NASA	Responsible Conduct of Research
NPR 1441.1 - NASA Records Management Program Requirements	NASA	Record Retention
NPR 1441.1 - NASA Records Management Program Requirements	NASA	Record Retention
NPR 1660.1C - NASA Counterintelligence and Counterterrorism (internal access only)	NASA	Foreign Influence
NPR 1800.1 - NASA Occupational Health Program Procedures	NASA	Lab Safety
NPR 1900.9 - Ethics Program Management Procedures Requirement	NASA	Financial COI
NPR 2190.1 - NASA Export Control Program	NASA	Export Control
NPR 2200.2 - Requirements for Documentation, Approval and Dissemination of NASA. Scientific and Technical Information (STI)	NASA	Publication
NPR 3335.1 - Internal Placement of NASA Employees	NASA	Hiring Practices
NPR 3713.3 – Anti-Harassment Procedures	NASA	Harassment
NPR 7100.1 - Protection of Human Research Subjects	NASA	Human Subjects Research
NPR 8705.6 - Safety and Mission Assurance (SMA) Audits, Reviews, and Assessments	NASA	Lab Safety
NPR 8715.3 - NASA General Safety Program Requirements	NASA	Lab Safety
NPR 8910.1 - Care and Use of Animals	NASA	Animal Subjects Research

NRRS 1441.1 - NASA Records Retention Schedule	NASA	Data Management
NRRS 1441.1 - NASA Records Retention Schedules	NASA	Record Retention
ODEO's Anti-Harassment website	NASA	bullying harassment
ODEO's Anti-Harassment website	NASA	Mentoring
Office of Special Counsel's website	OSC	Whistleblower Protection
Office of the Inspector General's website	NASA OIG	Whistleblower Protection
On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition	National Academy of Sciences, National Academy of Engineering, and Institute of Medicine	Responsible Conduct of Research
Open Science by Design: Realizing a Vision for 21st Century Research	National Academies of Sciences, Engineering and Medicine	Publication, Data Management
Overcoming Barriers to Collaborative Research	National Research Council	Collaborative Research
PowerPoint presentation: 2020 NASA Chemical Lab Safety Campaign	NASA	Lab Safety
Prudent Practices in the Laboratory Handling and Management of Chemical Hazards	National Research Council	Lab Safety
Reproducibility and Replicability in Science	National Academies of Sciences, Engineering, and Medicine	Data Presentation
SATERN Course: Ethics for NASA Employees	NASA	COI in Research
SATERN Course: Explore Partnerships (Modules 1-6), AG-PART-101-M01 – internal access only	NASA	Collaborative Research
SATERN Course: Export Control Management Awareness Training, HQ-NASA-	NASA	Export Control

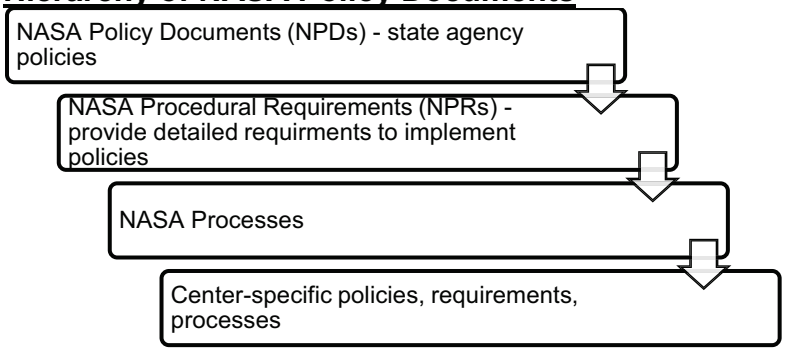
EXPCONT – *Internal access only*		
SATERN Course: Federal Records 101, AG-FEDREC-101 – Internal access only	NASA	Record Retention
SATERN Course: Laboratory Safety & Health, SMA-HQ-WBT-311 – internal access only	NASA	Lab Safety
SATERN Course: NASA Export Control Awareness Training, AG-ECP-001 – Internal access only	NASA	Export Control
SATERN Course: NASA Scientific and Technical Information	NASA	Publication
SATERN Course: No FEAR Act – internal access only	NASA	Whistleblower Protection
SATERN Course: Orientation to NASA Safety Culture, HQ-SMA-ONSC – Internal access only	NASA	Lab Safety
SATERN Course: Safety Culture for Supervisors, HQ-SMA-SCS – Internal access only	NASA	Lab Safety
Scientific Integrity presentation	NAS	Responsible Conduct of Research
Statement on Statistical Significance and P-Values	ASA	Data Analysis
STIPO website – internal access only	NASA	Publication
The Belmont Report	The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research	Human Subjects Research
The Declaration of Helsinki	World Medical Association	Human Subjects Research
The Nuremberg Code		Human Subjects Research

The Science of Effective Mentorship in STEMM	National Academies of Sciences, Engineering, and Medicine	Mentoring
The Sundowner Report	NASA	Animal Subjects Research
White paper on NASA science data retention	NASA	Record Retention

NASA Resources

NASA has numerous resources in place for the responsible conduct of research, including policies, procedural requirements, and processes. NASA policy documents are updated frequently. **Check the NASA Online Directives Information System (NODIS) to verify you have the correct version:** https://nodis3.gsfc.nasa.gov

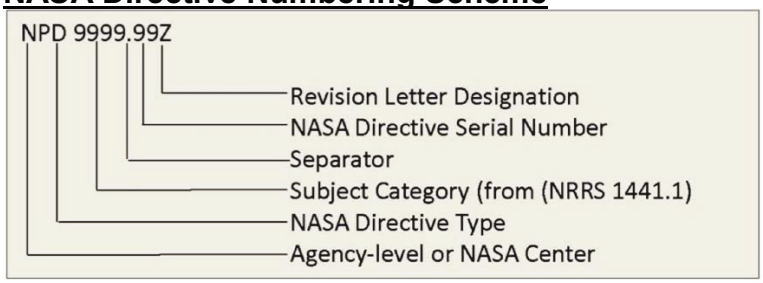
Hierarchy of NASA Policy Documents



In the event of conflicting requirements, the highest-ranking document takes precedence. For example:

- ~~CPR 9870.9~~ < NPR 9870.9
- NPD 1000.0 > ~~NPD 1000.3~~

NASA Directive Numbering Scheme



Appendix 2. Short Bio

Jessica Partridge is the Programmatic Lead in the Office of the Chief Scientist (OCS) at NASA Ames Research Center in Moffett Field, CA. In the OCS, she focuses on research integrity, relationships with current and potential collaborators, and interfacing with internal Ames communities. Jessica is a Student Trainee in the NASA Pathways Program while pursuing a M.S. in Research Administration from Johns Hopkins University. She has a B.A. in History from the University of California, San Diego